COMMONWEALTH OF MASSACHUSETTS

SUPREME JUDICIAL COURT

No. SJC-12310

COMMONWEALTH OF MASSACHUSETTS
Plaintiff/Appellee,
v.

CARA RINTALA
Defendant/Appellant

ON APPEAL FROM HAMPSHIRE DIVISION

OF THE SUPERIOR COURT DEPARTMENT

BRIEF OF THE CENTER FOR INTEGRITY IN FORENSIC SCIENCE AS AMICUS CURIAE IN SUPPORT OF DEFENDANT CARA RINTALA

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CORPORATE DISCLOSURE STATEMENT

Pursuant to SJC Rule 1:21 and Mass. R.A.P. 17(C)(1), the Center for Integrity in Forensic Science ("CIFS") states that it is a 501(c)(3) organization under the laws of the state of Wisconsin. CIFS does not issue any stock or have any parent corporation, and no publicly held corporation owns stock in CIFS.

RULE 17(C)(5) DECLARATION

CIFS and its counsel, Foley Hoag LLP, declare that (a) no party or party's counsel authored the brief in whole or in part, (b) no party or party's counsel contributed money that was intended to fund preparing or submitting the brief; (c) no person or entity—other than the amicus curiae, its members, or its counsel—contributed money that was intended to fund preparing or submitting the brief; and (d) neither amicus curiae nor its counsel represents or has represented any of the parties to the present appeal in another proceeding involving similar issues.

STATEMENT OF INTERESTS

The Center for Integrity in Forensic Sciences ("CIFS") is a non-profit organization dedicated to improving the quality and reliability of forensic science. Recognizing the important role that scientific and medical evidence plays in criminal cases, CIFS seeks to ensure that all forensic science evidence presented in courtrooms is valid and reliable.

In the last two decades, forensic science has become a mainstay of TV dramas and real-life courtrooms alike. Shows like "CSI," "Forensic Files," and "NCIS" have conditioned viewers to believe that forensic evidence is infallible. Juries, criminal justice experts, and even law enforcement officers are conditioned to believe the same. The allure is obvious—forensic science seems to provide definitive answers that are both scientific and impartial. When faced with the tricky question of a defendant's guilt or innocence, forensic science promises irresistible certainty.

But forensic science is far from infallible. Many common forensic techniques lack the safeguards associated with traditional science, like objectivity, openness, and uniform procedures. Compounding these issues is the fact that many forensic crime laboratories are adjuncts to law enforcement agencies, rather than independent scientific facilities. This means that crime labs start with the subjective biases of the criminal investigators who fund and control them, and analysts can face pressure,

overt or subtle, to reach a certain conclusion.[1] These problems are not just theoretical—of the 2,000-plus defendants exonerated since 1989, approximately 24 percent had trials which featured mistaken, exaggerated, or outright false testimony from forensic scientists.[2]

CIFS is not alone in raising these concerns. In 2009, the National Academic of Sciences ("NAS") published a groundbreaking report on the use of forensics in criminal trials (the "2009 NAS Report"). Citing the "notable dearth of peer-reviewed, published studies establishing the scientific bases and validity of many forensic methods," the report reached the extraordinary conclusion that, "[w]ith the exception of nuclear DNA analysis … no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source."[3] The report noted that "testimony based on faulty forensic science analyses may have contributed to wrongful convictions of innocent people … demonstrat[ing] the potential danger of giving undue weight to evidence and testimony derived from

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[1] Paul C. Giannelli, *Independent Crime Laboratories: The Problem of Motivational and Cognitive Bias*, 603 Faculty Publications 247, 247 (2010).
[2] Center for Integrity in Forensic Sciences, *About CIFS: Exclusive Focus on Strengthening Forensic Science*, CIFSJustice.org, *available at* https://cifsjustice.org/about-cifs/reform-in-forensic-sciences/.
[3] National Academy of Sciences, Committee on Identifying the Needs of the Forensic Sciences Community, *Strengthening Forensic Science in the United States: A Path Forward,* 7 (August 2009) (cited hereafter as "2009 NAS Report").

imperfect testing and analysis,"[4] and cautioned that "[t]he findings of forensic science experts are vulnerable to cognitive and contextual bias."[5] The 2009 NAS Report was followed by an even more critical 2016 report from the President's Council of Advisors on Science and Technology, which found serious errors in a host of commonly-used forensic methods, including bite-mark analysis, latent fingerprint analysis, firearms analysis, footprint analysis, and hair analysis.[6]

As an expert in the field, CIFS has found that many wrongful convictions resting on forensic science evidence have a number of factors in common. Most relevant to this case are two particular factors that often go hand in hand: (1) forensic expert and analyst error, and (2) the failure to subject expert opinions to rigorous adversarial testing. CIFS is aware of a number of wrongful convictions in which incorrect expert testimony played a critical role, but whether there is a wrongful conviction or not, faulty forensic science damages the criminal justice system by depriving an accused person of due process and should not be used to obtain criminal convictions.

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[4] *Id.* at 4.
[5] *Id.* at 8 n.8.
[6] *See generally* President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (September 2016) *available at* https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf.

SUMMARY OF THE ARGUMENT

Scientists, scholars, lawyers, and others have long been concerned that forensic science lacks the safeguards often associated with other sciences and is not adequately reliable for its purpose. Arg. at 13. In 2009, the National Academy of Sciences (the "NAS") published a report criticizing many of the established forensic sciences as lacking foundational validity and adequate scientific research. The NAS further found that many forensic science analysts testified outside the bounds of what science could support, exaggerating their opinions or offering opinions that could not be supported. Scholars have further recognized that these inadequate underpinnings are often compounded by cognitive bias. Arg. at 19. While forensic sciences have inadequate safeguards and foundations, the opinions in this case, particularly with respect to the testimony about paint, lack even those minimal and insufficient protections. Arg. at 24. Because the conviction in this case rests heavily on forensic science testimony that cannot bear its weight, CIFS urges this Court to find that the trial judge's denial of the defendant's motion in limine to exclude David Guilianelli's opinion testimony was an abuse of discretion and prejudicial error requiring reversal of the defendant's conviction and a new trial. In the alternative, CIFS urges the court to vacate the denial of the Defendant's motion for a new trial and remand the case to the trial court for an evidentiary hearing so that the trial court

can receive evidence under oath on the reliability of Mr. Guilianelli's opinions from qualified scientists. Arg. at 36.

ARGUMENT

I. ESTABLISHED FORENSIC SCIENCE DISCIPLINES ARE FRAUGHT WITH ERROR, BUT THE RISK OF ERROR IS HEIGHTENED IN NOVEL DISCIPLINES LACKING FOUNDATIONAL VALIDITY

While many well-established forensic science disciplines have been shown to lack appropriate scientific foundation and can lead to unjust legal system outcomes, this risk is particularly acute where the scientific discipline or analysis at issue is novel, not rooted in the scientific method, lacking in foundational validity, internally inconsistent, or created for application to a particular case. The system demands that judges act as gatekeepers for forensic evidence, ensuring that all scientific testimony is both relevant and reliable.[7] In such a scenario as this, courts should view such evidence with particular skepticism and carefully evaluate it in light of the known shortcomings of forensic analysis.

Since the advent of the 2009 NAS Report, many well-established disciplines have come under long-overdue scrutiny. The 2009 NAS Report was particularly concerned with the danger of forensic sciences that were developed largely or solely

[7] *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 589 (1993).

for use in the courtroom, contrasting those disciplines with those that have foundational validity established via traditional scientific channels and not primarily for forensic use (for example, single-source nuclear DNA analysis).[8] As the Supreme Court recognized in *Daubert*, "there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory."[9]

Forensic science, like all good science, should follow the scientific method—that is, "the process by which scientists collectively, and over time, attempt to create an accurate (that is, reliable, consistent and non-arbitrary) representation of the world."[10] The scientific method involves the following steps: the observation and collection of data; the formation of possible explanations for the data through a hypothesis; experimentation to test the hypothesis; and a final interpretation of the results.[11] Underlying these steps are the "hallmarks of basic science: the use of validated methods and care in following their protocols; the development of careful and adequate documentation; the avoidance of biases; and interpretation conducted within the constraints of what the science will allow."[12]

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[8] 2009 NAS Report at 101.
[9] *Daubert*, 509 U.S. at 597.
[10] *Lasalvia v. Johnson*, 2003 Mass. Super. LEXIS 9 at *8 (Mass. Super. Ct. Jan. 16, 2003) citing Wilson, AN INTRODUCTION TO SCIENTIFIC RESEARCH, McGraw-Hill (1952); Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS, Univ. of Chicago Press (1962); Barrow, THEORIES OF EVERYTHING, Oxford Univ. Press (1991).
[11] *Lasalvia*, 2003 Mass. Super. LEXIS 9 at *8-9.
[12] 2009 NAS Report at 113.

All too often, however, forensic science evidence does not follow this time-tested method for reaching scientific truth. The 2009 NAS Report meticulously enumerates these shortcomings. Congress, recognizing the problems with forensic science, directed the National Academy of Sciences to undertake a study and draft a comprehensive report for progress in the forensic science community and its scientific disciplines.[13] Ultimately, the National Academy of Sciences study revealed that "substantive information and testimony based on faulty forensic science analyses may have contributed to wrongful convictions of innocent people. This fact has demonstrated the potential danger of giving undue weight to evidence and testimony derived from imperfect testing and analysis. Moreover, imprecise or exaggerated expert testimony has sometimes contributed to the admission of erroneous or misleading evidence."[14]

An additional—and intertwined—problem in traditional forensic sciences is the high subjectivity of these disciplines, especially those that focus on pattern discernment. Studies have shown that subjectivity can lead to significant error in pattern matching disciplines, especially when analysts are exposed to case-specific, domain-irrelevant facts.[15] Such facts may include the nature of the crime, lurid facts

[13] 2009 NAS Report at xix.
[14] *Id.* at 4.
[15] *See, e.g.*, Glinda S. Cooper & Vanessa Meterko, *Cognitive Bias Research in Forensic Science: A Systematic Review*, 297 FORENSIC SCI. INT'L 35 (2019)

about the crime, information about the accused, or suggestive retellings by law enforcement. This type of contamination combines with the inherent subjectivity of many forensic science disciplines to lead to incorrect results.

Leading scholars describe the factors underlying overstated forensic evidence in this way:

> "(1) Across many domains, experts are often overconfident in their abilities (e.g., Baumann, Deber, & Thompson, 1991); (2) the courts, for the most part, have blindly accepted forensic science evidence without much scrutiny (Mnookin et al., 2011); (3) errors are often not apparent in the forensic sciences because ground truth is often not known as a matter of certainty; (4) many forensic examiners work for police and appear in court as advocates for the prosecution; and (5) many forensic examiners consider themselves objective and immune to bias. As stated by the Chair of the Fingerprint Society: "Any fingerprint examiner who comes to a decision on identification and is swayed either way in that decision making process under the influence of stories and gory images is either totally incapable of performing the noble tasks expected of him/her or is so immature he/she should seek employment at Disneyland" (Leadbetter, 2007)."[16]

Forensic science is also influenced by non-scientific elements. Crime labs were developed in the 1920s as an adjunct of police departments.[17] Since then, "'[t]he exigencies imposed on [labs] by police and prosecutors [have] molded [the

[16] Kassin et al., *The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions*, 2 J. APPL. RES. MEM. COGN., 42 (2013) at 43.
[17] Giannelli at 250.

labs] into [their] contemporary shape.'"[18] Forensic analysis is thus said to have "[grown] up in the criminal law."[19]

The disciplines of law enforcement and forensic science remain heavily connected today.[20] For example, a study of 300 crime labs revealed that 79 percent are still located within law enforcement or public safety agencies, and 90 percent of the accredited ones are organized under police agencies.[21] These labs work hand in hand with, and in close proximity to, the police throughout the investigation. This comes with a host of problems. Key among them is the impact on the integrity of resulting forensics. In fact, courts, legislators, prosecutors, investigators, reporters, and scholars have noted for decades the "inbred bias of crime laboratories affiliated with law enforcement agencies."[22]

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[18] J. Herbie DiFonzo and Ruth C. Stern, *Devil in a White Coat: The Temptation of Forensic Evidence in the Age of CSI*, 41 NEW ENG. L. REV. 503, 516 (2007).
[19] *Id.*
[20] While most of the research into, and criticism of, the biases related to role effects and distilling of evidence involve the close relationships between police and crime laboratories, the problems related to those close relationships are not alleviated by using experts who are not employees of law enforcement agencies. In this case, an employee of a paint company was hired by law enforcement to develop evidence against a specific suspect after two mistrials. Given these circumstances, the problems inherent to cases in which forensic analysts are exposed to biasing information and perceived to be a part of the prosecution team are present, even though the expert in question is not a crime lab employee.
[21] Giannelli at 250.
[22] Giannelli at 247.

The close relationship between forensic labs and police departments (or prosecutors and their witnesses) influences the analysts' scientific process. Structural bias leads investigators to "focus on a suspect," and "select and filter the evidence that will 'build a case' for conviction, while ignoring or suppressing evidence that points away from guilt."[23] They seek out the crime and work to create the criminal.[24] Evidence is thus distilled before it even comes in front of a forensic science analyst, by those unqualified to assess its value, and on subjective grounds. A 2007 study found that the leading reason police do not send forensic evidence to the lab is that a particular suspect has not been identified, thereby presumably suggesting that only evidence perceived as relevant to that suspect should or would be sent. Other reasons include that the "officers did not feel the evidence was useful to the case," and the "analysis was not requested by [the] prosecutor."[25] These justifications are neither scientific nor objective; they evince guesswork. Yet they provide the backdrop for the data on which the scientific method will commence.

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[23] Dianne L. Martin, *Lessons About Justice from the "Laboratory" of Wrongful Convictions: Tunnel Vision, the Construction of Guilt and Informer Evidence,* 70 UMKC L. REV. 847, 848 (2002).

[24] In this case, the crime (murder) and the suspect (Cara Rintala) were known to the analyst prior to his analysis. This is an alternate form of bias, but closely related; what's more, the cognitive bias issues remain similar.

[25] Nancy Ritter, *Untested Evidence: Not Just a Crime Lab Issue, National Institute of Justice* (May 25, 2010), https://nij.ojp.gov/topics/articles/untested-evidence-not-just-crime-lab-issue.

By the time it arrives to be analyzed, the evidence before the examiner is evidence of supposed guilt. This is critical: 57 percent of examiners would examine *only* this evidence without further follow-up or independent searching.[26] Thus for the forensics to portray an accurate assessment of the crime, the police work at the outset would need to be objective and forensically sound. But that is exactly what the examiners are trying to test. This backwards approach is not only unscientific, it is defective, and directly impacts the reliability of the resulting forensic conclusions.

Moreover, "examiner bias" is a real danger to scientific integrity.[27] In criminal investigations, police routinely provide -- on the form requesting the scientific test -- a detailed narrative of the crime and an inventory of other inculpatory information they have accumulated against the suspect.[28] Forensic experts are frequently exposed to irrelevant facts about the suspect's personal circumstances.[29] But these pieces of

[26] Giannelli at 250.
[27] Peter J. Neufeld, *The (Near) Irrelevance of Daubert To Criminal Justice and Some Suggestions for Reform*, American Public Health Association (2005), https://ajph.aphapublications.org/doi/10.2105/AJPH.2004.056333.
[28] *Id*.
[29] Itiel E. Dror, *Bias in forensic experts*, 360 Science 243, 243 (2018), *available at* https://science.sciencemag.org/content/sci/360/6386/243.full.pdf.

information are extraneous to the forensic analysis and irrelevant to proper methodology.[30]

Knowledge of the investigator's "theory of a crime" can lead to confirmation bias.[31] The effects of cognitive biases are well-documented in forensic science.[32] Research has found that labs tend to test the police's hypothesis by looking for instances that confirm it, rather than by searching for data that would refute it.[33] The error rate from bias is even higher where conclusions are subjective. For example, one study of diagnosis in forensic pathology presented pathologists with a set of photographs selected to show "classic" examples of skin injuries (*i.e.*, photographs from pathology curricula depicting common injuries[34]), with the expectation that the

[30] A 2017 survey found that the majority of forensic examiners recognized the possibility that such outside information could affect their analysis. Benedette Cuffari, *Forensic Confirmation Bias (Cognitive Bias in Forensics)* (May 2019), *available at* https://www.news-medical.net/life-sciences/Forensic-Confirmation-Bias-(Cognitive-Bias-in-Forensics).aspx.

[31] Giannelli at 254.

[32] *See, e.g.*, President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* at 31-32 (2016), *available at* https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf; Cooper, "Cognitive Bias Research in Forensic Science: A Systematic Review," 297 FORENSIC SCI. INT'L 35 (2019).

[33] Giannelli at 254.

[34] This was a study of consensus, not correctness, so the diagnoses were not independently verified but rather taken from teaching materials and other collections.

results would show "high consensus and high confidence of diagnosis."[35] Instead, the forensic pathologists displayed a "surprising" lack of consensus in identifying the cause of the injuries.[36] A follow-up study examined the lack of consensus and found that pathologists noted "significant ambiguity" in diagnosing even the "classic" examples of skin injuries, particularly where the diagnosis was made by visual examination of a photograph "in the absence of history and context."[37]

Relatedly, investigators feed off of their sought-after hypothesis. Most investigators do not look to the lab for help developing leads or generating new suspects.[38] Rather, they seek confirmation of their own developing theory in order to corroborate their investigation.[39]

The symbiotic relationship between the investigators and forensic team, and the biases that result, do not create impartial science. The outcome is instead littered

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[35] Oliver & Fang, *Forensic Pathologist Consensus in the Interpretation of Photographs of Patterned Injuries of the Skin*, 61 J. FORENSIC SCI. 972, 972 (July 2016).
[36] *Id.* at 976.
[37] Oliver, *Reasons for Lack of Consensus in Forensic Pathologist Interpretation of Photographs of Patterns of Injury of the Skin*, 62 J. FORENSIC SCI. 674, 679 (May 2017).
[38] Joseph L. Peterson, Steven Mihajlovic, Michael Gilliland, *Forensic Evidence and the Police: The Effects of Scientific Evidence on Criminal Investigations*, U.S. Department of Justice (1984), *available at* https://www.ncjrs.gov/pdffiles1/95704.pdf.
[39] *Id.*

with prejudices and predispositions.[40] A 2011 experiment demonstrates this point.[41] In that study, researchers obtained the printed DNA results from a rape case. The original genetic analysts in the case had been told that police had a particular suspect in custody. The forensic experts then reached a conclusion that the suspect's DNA was part of the crime scene sample. To evaluate whether knowledge of the arrest caused bias, the researchers provided the DNA printouts to 17 experts unconnected with the case and told them nothing about the suspect. Only one matched the suspect's DNA to the crime sample.[42] Even though DNA evidence can be evaluated in a rigorous and consistent manner, it is not immune from the pollution of bias.

This issue is further compounded by the pro-prosecution leaning of a witnesses testifying for the government. Known as "role effect bias," a person's

[40] *See* 2009 NAS Report at 8, n. 8 ("The findings of forensic science experts are vulnerable to cognitive and contextual bias. Contextual information renders experts vulnerable to making erroneous identifications. Unfortunately, at least to date, there is no good evidence to indicate that the forensic science community has made a sufficient effort to address the bias issue; thus, it is impossible for the committee to fully assess the magnitude of the problem.") (internal citations omitted).
[41] Itiel E. Dror, Greg Hampikian, *Subjectivity and bias in forensic DNA mixture interpretation,* 51 SCI JUSTICE 204–8 (2011).
[42] *Id*.

perception of their role can influence their decisions.[43] Perceiving their role as part of the investigation team, these examiners come to see their function as assisting the police.[44] At least one former laboratory director provided observational evidence to support this concept: in his experience, many forensic scientists in state police labs saw their role as members of the state's attorney's team, as if they were the prosecution witnesses instead of just scientists.[45]

This reality led to the fourth, fifth and sixth recommendations of the 2009 NAS Report:

> "Scientific and medical assessment conducted in forensic investigations should be independent of law enforcement efforts either to prosecute criminal suspects or even to determine whether a criminal act has indeed been committed. Administratively, this means that forensic scientists should function independently of law enforcement administrators. The best science is conducted in a scientific setting as opposed to a law enforcement setting. … [And], The National Institute of Forensic Science (NIFS) should encourage research programs on human observer bias and sources of human error in forensic examinations. … includ[ing] studies to determine the effects of contextual bias in forensic practice (e.g., studies to determine whether and to what extent the results of forensic analyses are influenced by

[43] Giannelli at 252; Panayiota Kendeou et al., MISINFORMATION AND FAKE NEWS IN EDUCATION; COGNITIVE BIASES IN FORENSIC SCIENCE TRAINING AND EDUCATION, 85 (2019) ("Prosecutorial bias, a type of role effect bias, is when examiners subconsciously align themselves with the prosecution regardless of analytical results."); *see also* 2009 NAS Report at 79 ("And because both are part of a prosecutorial department of the government, they could be subject to subtle contextual biases that should not be allowed to undercut the power of forensic science.").

[44] Giannelli at 252.

[45] *Id.*

> knowledge regarding the background of the suspect and the investigator's theory of the case)."[46]

The danger of being a part of the "prosecution team" is that forensic scientists may become partisan,[47] their loyalty to their job and not to the science.[48] Critically, these biases are hardly ever raised and often entirely unnoticed. So "even though incriminating expert evidence is routinely developed in conditions that are known to produce errors, it is nevertheless portrayed as independent, objective and sometimes even 'error-free.'"[49]

II. FLAWED FORENSIC SCIENCE CONTRIBUTED TO CARA RINTALA'S CONVICTION

All of the problems detailed above occur in established forensic science disciplines. These disciplines, though established, can be problematic because of the errors, biases, and validity problems listed. As explained above, even the "gold standard" of forensic science, DNA, is affected by these shortcomings. That makes the reliance on David Guilianelli's opinions in this case all the more shocking. Mr. Guilianelli's opinions do not result from the application of an established forensic

[46] 2009 NAS Report at 23-24.
[47] Giannelli at 248.
[48] DiFonzo and Stern at 516.
[49] Gary Edmond et al., *Contextual bias and cross-contamination in the forensic sciences: the corrosive implications for investigations, plead bargains, trials and appeals*, 14 L. PROBABILITY AND RISK 1, 2 (2015).

science discipline. In this case, the opinions presented to the jury lack even the minimal safeguards provided by established disciplines.

a. The Paint Drying Analysis In This Case Is An Example Of An Unscientific Opinion Created For The Courtroom And Lacking Foundational Validity

Mr. Guilianelli's opinions related to spilled paint are a particularly troubling example of an unscientific opinion created for the courtroom and lacking in foundational validity. These opinions are contaminated with extraneous information, subject to bias, unscientific, and too unreliable to be used in the courtroom.

While standards governing the analysis of paint evidence do exist[50] (indeed, they are discussed at length in the 2009 NAS Report), those standards are not applicable here. Current standards related to paint and coatings, while themselves not infallible, do at least set out procedures for analyzing coatings in a forensic setting that are based in the appropriate sciences.[51] These standards do not, however, apply to the drying time or drying characteristics of pools of architectural paints, nor do they address how to analyze the drying times or physical characteristics of paint on a human body. CIFS is not aware of other cases in which the drying time of pools of paint were used to establish time of death, and, more importantly, not aware of

[50] *See, e.g.*, ASTM International, *E1610-18 Standard Guide for Forensic Paint Analysis and Comparison*, West Conshohocken, PA, ASTM International, 2018. *available at*: https://doi-org.ezproxy.library.wisc.edu/10.1520/E1610-18
[51] 2009 NAS Report at 170.

any uniform standards or guidance for the use of this type of evidence in courts. In other words, this is a novel type of evidence that is highly subjective and lacks any of the safeguards (inadequate as they may be) present in established forensic science disciplines. Scientific evidence need not be a well-established forensic technique in order to be admissible in court; however, proffered scientific evidence must meet the standards set out for reliability.[52] The validity of a scientific technique is not an issue for the jury to weigh.[53] Judges determine reliability, relevance, and "fit."[54]

Unconscious bias is a problem even in the most established forensic sciences, including DNA interpretation.[55] Importantly, in the absence of recognized procedures and standards, subjectivity (and, relatedly, risk of bias) tends to increase. In this case, Mr. Guilianelli apparently had access to a great deal of domain irrelevant information. While neither his report nor his testimony contains a comprehensive

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[52] *See, e.g.*, P. Giannelli & E. Imwinkelried, CRIMINAL EVIDENCE 83–90 (1979).

[53] *See, e.g., Allison v. McGhan Med. Corp* 184 F.3d 1300, 1310 (11th Cir. 1999) ("While meticulous Daubert inquiries may bring judges under criticism for donning white coats and making determinations that are outside their field of expertise, the Supreme Court has obviously deemed this less objectionable than dumping a barrage of questionable scientific evidence on a jury, who would likely be even less equipped than the judge to make reliability and relevance determinations and more likely than the judge to be awestruck by the expert's mystique.")

[54] *See, e.g., U.S. v. Schiff*, 602 F.3d 152, 172–73 (3d Cir. 2010), *Daubert*, 509 U.S. at 591, 113 S.Ct. 2786.

[55] *See, e.g.*, Itiel E. Dror, Greg Hampikian, *Subjectivity and bias in forensic DNA mixture interpretation*, 51 SCI JUSTICE 204–8 (2011).

account of all materials and statements he reviewed, or of conversations he had with prosecutors or law enforcement officers, it is clear that he received at least some biasing information, in the form of case file information, photographs, and conversations with others. As explained below, there are approaches to reducing bias that can be used in criminal casework and are especially critical when using a novel or unusual technique.

One example of a better approach in this case—at least, in terms of reducing some cognitive bias—involves a sequential unmasking procedure. Linear Sequential Unmasking procedures are based on the premise that, ideally, analysts would be protected from potentially biasing information but, if exposure is necessary, it should be done as late in the process as possible, and this process, as well as any assumptions the analyst makes throughout, should be carefully documented.[56] Cognitive neuroscience experts recommend this type of approach to reduce bias and error.[57] While this would not have eliminated all problems with Mr. Guilianelli's approach, it at least would have offered an opportunity to reduce examiner bias. These procedures are critically important here, where the risk of bias was higher because the testing was novel and without established principles and procedures.

[56] Dror et al., *Context Management Toolbox: A Linear Sequential Unmasking (LSU) Approach for Minimizing Cognitive Bias in Forensic Decision Making*, 60 J. FORENSIC SCI. 111 (2015).
[57] *See, e.g.*, Itiel E. Dror, *Biases in Forensic Experts*, 360 Science 243 (2018).

But Mr. Guilianelli did not conduct objective, repeated testing. Instead, he appeared to engage in a process designed to reach a pre-formed conclusion, rather than conducting testing in order to reach an objective result. Further, he based his own subjective analysis on the subjective and sometimes contradicting statements of others. For example, he credited some of the first responders' observations while ignoring others. This is a well-recognized form of cognitive bias known as confirmation bias, a cognitive error in which a person accepts facts that support their previously formed beliefs while rejecting facts that do not fall into line with those same beliefs. This is a well-recognized phenomenon in police investigations generally and forensic science cases specifically.[58]

Although Mr. Guilianelli did not have recognized forensic standards to follow in this case, he could have relied on the scientific method to come to a more reliable conclusion. But he did not. Instead of making observations, collecting data, forming a hypothesis, and testing that hypothesis through controlled and rigorous experiments replicating substantially similar conditions, Mr. Guilianelli conducted a small number of haphazard experiments that failed to control for important characteristics of the paint in the basement environment, and which ultimately relied on his own subjective comparison between his "findings" based on those

[58] Kassin et al. *The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions,* 2 J. APPL. RES. MEM. COGN. 42 (2013).

experiments and crime scene photographs. The opinions he proffered fall short of the standards set forth in *Daubert* and its progeny.

In other words, while the NAS says forensic science disciplines in general lack appropriate scientific foundations, the testimony in this case lacks even the inadequate safeguards and scientific foundation of traditional forensic science disciplines.

b. Opinions Regarding Intentional Pouring Of Paint Are Wholly Subjective And Based On Unsupported Speculation

CIFS is not aware of any examples of criminal cases hinging upon the determination of intentional pouring versus accidental spilling of paint. There are, however, numerous examples of cases in which unsupported speculation about mental states of alleged perpetrators have led to unjust results.

Other forensic science disciplines have attempted to divine the intent of an alleged perpetrator by forming opinions about the behavior of various liquids. In arson cases, so-called "pour patterns" and other floor patterns in building fires were long used as proof that a fire was intentionally started using an incendiary liquid. Experimentation and research revealed that these marks, thought to be made by ignited liquids, came into being through other processes and did not reliably indicate

whether a fire was arson or whether it involved liquid accelerants.[59] Modern fire scientists no longer use this and other "fire folklore" to investigate arson.[60] While this case does not involve an arson accusation, the trajectory of arson investigation is illustrative. This is because arson investigation historically employed the observations of individuals who were thought to be highly trained and experienced, but, like Mr. Guilianelli, did not base their opinions on appropriate scientific data. Faulty arson opinions have resulted in numerous wrongful convictions.[61]

Another forensic discipline, bloodstain pattern analysis (sometimes called "blood spatter") also endeavors to determine the *mens rea* of an alleged perpetrator by examining patterns of liquid stains. The 2009 NAS Report identified a variety of troubling problems with bloodstain pattern analysis, including an "emphasis on

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[59] *See, e.g.*, Gorbett et al., *Use of Damage in Fire Investigation: A Review of Fire Patterns Analysis, Research, and Future Direction*, 4 Fire Science Reviews, 1, 16 (2015).

[60] NFPA 921, *Guide for Explosion and Fire Investigations*, 2008 Edition. Quincy, MA: National Fire Protection Association.

[61] *See, e.g.*, The National Registry of Exonerations, *David Lee Gavitt*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3911 (August 6, 2019); The National Registry of Exonerations, *Sheila Bryan*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3066 (April 2, 2021); The National Registry of Exonerations, *Weldon Wayne Carr*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3936 (July 3, 2012); The National Registry of Exonerations, *Ernest Ray Willis*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3755 (Before June 2012); The National Registry of Exonerations, *Amaury Villalobos*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=4813 (February 23, 2018).

experience over scientific foundations" and that "[i]n general, the opinions of bloodstain pattern analysts are more subjective than scientific."[62] Bloodstain pattern analysts have proffered opinions that extend far beyond what could be scientifically supported.[63] Ultimately, the NAS concluded that "the uncertainties associated with bloodstain pattern analysis are enormous."[64] This highly subjective discipline has resulted in numerous wrongful convictions.[65]

The lesson to be gleaned from these cases is that ambiguous evidence, like the pooled paint in this case, cannot lead to reliable determinations about the mental state of an alleged perpetrator (here, whether the paint was intentionally poured or accidentally spilled). In the foregoing examples, the assumptions are based on a foundation that is lacking. In the instant case, the assumptions are based on even less. Certainly in this case, where the paint testing was entirely inadequate for the

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[62] 2009 NAS Report at 178

[63] 2009 NAS Report at 179.

[64] *Id*.

[65] *See*, *e.g.*, The National Registry of Exonerations, *Freda Susie Mowbray*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3495 (Before June 2012); The National Registry of Exonerations, *David Camm*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=4291 (March 13, 2019); The National Registry of Exonerations, *Jennifer Weathington*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=5554 (May 16, 2019); The National Registry of Exonerations, *Clemente Aguirre-Jarquin*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=5406 (January 28, 2020); The National Registry of Exonerations, *Julie Rea*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3278 (Before June 2012).

purposes of forming an opinion about drying, movement, and pooling, it is even more inadequate for the purposes of forming an opinion about intentional pouring versus accidental spilling.

c. Other Subjective Determinations Can Compound Forensic Science Error

The factors that lead to erroneous forensic opinions are often intertwined rather than independent. A false confession, for example, might be extracted with the use of false forensic science testimony. In a false evidence ploy, investigators might tell a suspect that forensic evidence implicates him, and that he will likely receive the death penalty if he does not confess.[66] The accused person then confesses, believing that the evidence, once truly analyzed, will exonerate him, but is never able to overcome the powerful evidence of confession. In this scenario, the confession cannot be understood as anything other than integral to—and indeed induced by—the false evidence. Multiple factors can work together in these "bias snowballs."[67]

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[66] This is what happened to Christopher Ochoa, who served 12 years in prison in Texas for a crime he did not commit. The National Registry of Exonerations, *Christopher Ochoa*, https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3511 (May 26, 2020).

[67] Dror et al. *The Bias Snowball and the Bias Cascade Effects: Two Distinct Biases That May Impact Forensic Decision Making*, 62 J. FORENSIC SCI. 832 (2017)

The bias snowball effect acknowledges that forensic work can be biased both by other sources (for example, knowing a suspect confessed to a crime) at the same time it biases other streams of evidence (for example, a bite mark analyst being influenced by knowing the DNA analyst's work implicated a particular suspect).[68] The risk of bias is heightened when examiners are aware of the work of others prior to reaching their conclusions.[69] In this case, having two prior trials that focused on the time of death analysis performed by the medical examiner may have influenced Mr. Guilianelli's conclusions regarding the paint. The lack of a standardized process for examining the paint and a highly subjective and unscientific method of reaching conclusions increases the testimony's vulnerability to bias and error.

While it appears that, in this case, the paint testimony may have significantly influenced the jury to reach a guilty verdict in this case after two mistrials,[70] it is also important to consider the interplay between the paint testimony and other opinion evidence.

Time of death analysis, while generally admissible, presents some serious problems that can lead to unjust judicial outcomes, especially when the expert's

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[68] *Id.*

[69] *Id.*

[70] The parties' briefing indicates that jurors were influenced by the paint testimony (*See, e.g.* D.Br.79-80 (Dateline interview), Comm.Br. 86 ("If anything, the Commonwealth's evidence was stronger at the defendant's third trial, with the addition of expert testimony from Guilianelli and Dr. Andrew").

conclusion is the product of unsound methodology. When opinions are not the product of reliable principles, reliably applied, they properly must be excluded, even if similar opinions, reached under different circumstances, have previously been admissible. Time of death determinations are certainly not infallible, and should be supported with independent, reliable data. It is especially problematic here because of the way it was paired with the unscientific testimony about the paint, leading to the "bias snowball" phenomenon.

Many different factors can affect things like rigor mortis, and windows of time may not be accurate (experts in this case recognized some of the myriad factors that can change rigor, including body weight of decedent, a premortem struggle/violence, environmental factors, and individual variation).[71] There was some contention in the briefing about the training and experience of the first responders who made observations about the decedent's body. Even highly trained and experienced individuals may err when making observations and conclusions, but here, the attention and goals of a first responder—no matter how experienced—differ from those of a death investigator.

[71] *See Commonwealth of Massachusetts v. Cara Rintala,* Hampshire Superior Court, Docket No. 11-128, Trial Transcripts ("Third Trial Transcripts"), Day 8 (Sept. 27, 2016), page 142, Day 9 (Sept. 28, 2016), page 37 and Day 11 (Sept. 30, 2016), page 46 (violent struggle can affect onset of rigor). Day 11 (Sept. 30, 2016), pages 39-40 (obesity can affect onset of rigor).

Forensic pathologists are highly-trained medical experts, but this does not make them immune to cognitive bias. There is no question that bias and error exist in medicine. Studies have shown that race, gender, and personal circumstances affect all aspects of a person's interaction with the physicians, including diagnosis, treatment, and even the length of time a person waits to see a provider.[72]

In this case, the time of death estimates are particularly suspect, because they relied upon the subjective observations of others,[73] rather than objective measurements, like an accurate core temperature reading. A lack of objective data can lead to medical error. Diagnostic error is common in medicine, with a rate of about 10-20%; these error rates are lower when diagnoses are based more heavily in objective data and higher when more subjectivity is present.[74] Just as forensic scientists can be influenced by task-irrelevant information, medical decision-making can be affected by both medical and non-medical information. A recent study showed that pathologists' medical decisions are affected by non-medical

[72] *See, e.g.*, Institute of Medicine, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC, The National Academies Press. *Available at*: https://doi.org/10.17226/12875; Ray et al., *Disparities in Time Spent Seeking Medical Care in the United States*, 175 JAMA INTERN. MED. 1983 (2015).

[73] Some of these statements are both subjective and hyperbolic; for example, describing the body as "ice cold." Third Trial Transcripts, Day 2 (Sept. 15, 2016), pages 81-82.

[74] Mark L. Graber et al., Bringing Diagnosis into the Quality and Safety Equations, 308 JAMA 1211 (2012). See also, e.g., Berner & Graber, Overconfidence as a Cause of Diagnostic Error in Medicine, 121 AM. J. MED. S2 (2008).

information; forensic pathologists in this study changed their cause and manner of death determinations when medically irrelevant information was altered (*e.g.*, the race of the patient).[75] These studies demonstrate that forensic pathologists' decision-making is affected by a wide variety of factors and that even these highly-trained professionals may err. These errors do not exist in isolation, but become integrated into a particular case, creating the "bias snowball" phenomenon explained above and becoming inextricable from the other aspects of the case. In other words, while it may seem that the time of death determination is separate from the paint opinions, they cannot be entirely separated in the context of this case.

CONCLUSION

The testimony introduced at Cara Rintala's trial was profoundly flawed. These flaws extended far beyond the previously recognized concerns about forensic reliability and objectivity and lacked even the barest safeguards. Because it is so powerful to fact finders, it is critical to ensure that the forensic science presented in a trial is reliable and accurate. Faulty forensic science damages the criminal justice system by depriving an accused person of due process and should not be used to obtain criminal convictions. For this reason, CIFS urges this court to find that the

[75] Dror et al. *Cognitive Bias in Forensic Pathology Decisions*, 00 J. FORENSIC Sci. 1 (2021) *available at*: https://onlinelibrary.wiley.com/doi/epdf/10.1111/1556-4029.14697.

trial judge's denial of the defendant's motion in limine to exclude David Guilianelli's opinion testimony was an abuse of discretion and prejudicial error requiring reversal of the defendant's conviction and a new trial. In the alternative, CIFS urges the court to vacate the denial of the Defendant's motion for a new trial and remand the case to the trial court for an evidentiary hearing so that the trial court can receive evidence under oath on the reliability of Mr. Guilianelli's opinions from qualified scientists, such as Professor Arghavan Loughalam.

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Respectfully Submitted,

THE CENTER FOR INTEGRITY IN FORENSIC SCIENCE

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CERTIFICATION PURSUANT TO MASS. R. APP. P. 16(K)

I, Rachel L. Davidson, certify that this brief complies with the rules of court that pertain to the filing of briefs, including but not limited to Mass. R. App. 16(a)(6), 16(a)(13), 16(e), 16(f), 16(h), 18, and 20. Rule 21 is not applicable to this brief. Compliance with Rule 20 was ascertained by using size 14 Times New Roman font, limiting the number of non-excluded words to 6.598, and using Microsoft Word version 2016.

/s/ Rachel L. Davidson

Rachel L. Davidson (BBO #703341)

CERTIFICATE OF SERVICE

I, Rachel L. Davidson, certify that on April 21, 2021, I filed the forgoing Motion for Leave of the Center for Integrity in Forensic Science in Support of Defendant/Appellant Cara Rintala in *Commonwealth v. Rintala*, SJC-12310 with the Supreme Judicial Court by electronic service. This brief was served through the electronic filing system on counsel of record.

/s/ Rachel L. Davidson

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