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Forensics Educating Lawyers

Robert M. Sanger



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FORENSICS: EDUCATING THE LAWYERS

*Robert M. Sanger**

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INTRODUCTION¹

Thomas Kuhn famously wrote about the epistemological paradigm shift that has to occur in science in order for progress to be made.² As long as the current paradigm is accepted, even the most advanced thinking of those involved in a discipline will be limited by that paradigm. Historically, the transition from one paradigm to another often begins with a discomfort over the manner in which the data fits the paradigm. The data relating to what it means to be a lawyer or a judge is shifting, but the paradigm of the law school curriculum – the very framework in which lawyers and judges are educated – is slow to change.

The data shows that lawyers and judges are not adequately dealing with an important component of the job for which they were inadequately educated. The data empirically demonstrates that this inadequate education has resulted in a crisis in the courts.³ It is a crisis of forensic science. Wrongful convictions have been documented at an alarming rate and a substantial number of those wrongful convictions, including condemnation of innocent people to death, are the result of substandard forensic expert testimony.⁴ In addition, controversies regarding civil judgments have continued to proliferate focusing on what is characterized as “junk science” invoked either for the plaintiffs or the defendants – or, sometimes, both.⁵

At the heart of this empirically verifiable crisis in forensic science, including wrongful convictions and unsupported civil judgments, is the fact that the end-users – the lawyers and judges – are undereducated on what should be admissible in court. Law school education, the Juris Doctor (J.D.) curriculum, does not have a sufficient component related to forensic science. As a result, lawyers and judges are not intellectually equipped to litigate and

1. This article had its origins in a presentation by the author to the American Academy of Forensic Sciences Annual Scientific Meeting, Las Vegas, Nevada, (February 2016). Abstract Published as *Scientific Evidence and the Law School Curriculum*, at p. 598 of the AAFS PROCEEDINGS ABSTRACT F4 at: <http://www.aafs.org/wp-content/uploads/2016Proceedings.pdf>.

2. Thomas Kuhn, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS*, Chicago University Press (2nd ed. 1970).

3. See, e.g., Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 110 (2009). (“The judicial system is encumbered by, among other things, judges and lawyers who generally lack the scientific expertise necessary to comprehend and evaluate forensic evidence in an informed manner, . . .”); Peter J. Neufeld, 2005. *The (near) irrelevance of Daubert to criminal justice: And some suggestions for reform*, 95 AMERICAN JOURNAL OF PUBLIC HEALTH (Supp.1):S107, S109; Jane Campbell Moriarty & Michael J. Saks, *Forensic Science: Grand Goals, Tragic Flaws, and Judicial Gatekeeping*, JUDGES’ J., (Fall 2005), at 16, 28–29.

4. Brandon Garrett and Peter Neufeld, *Invalid Forensic Testimony and Wrongful Convictions*, 95 VIRGINIA LAW REVIEW 1 (2009); Giannelli, Paul C., *Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs*, 86 NORTH CAROLINA LAW REVIEW 163 (2007); Brandon L. Garrett, *Actual Innocence and Wrongful Conviction*, 3 REFORMING CRIMINAL JUSTICE: PRETRIAL AND TRIAL PROCESSES 193 (Erik Luna ed., 2017).

5. Peter Huber, *GALILEO’S REVENGE: JUNK SCIENCE IN THE COURTROOM*, Basic books (1991).

rule on the admissibility of forensic evidence and, where it is admissible, to fashion intelligent rulings regarding the scope of forensic opinions. This requires a paradigm shift in what constitutes a legal education.

This is not to diminish the good work of a minority of judges and lawyers who have actively pursued an education in forensics but it is to state the empirically demonstrated fact that, in the majority of courtrooms, substandard science still appears and can be outcome determinative. These results occur with the participation of the many lawyers and judges who have no significant forensic education but who are, nevertheless, the end-users of forensic services.⁶ The education of these end-users should begin in law school. However, there is a lack of structure to the forensic education, if any, that is offered as a part of the J.D. curriculum.⁷ The typical evidence class in law school dedicates only a week or two to forensic evidence while spending several weeks on the hearsay rule.⁸ Electives in forensics are on the potential class list of many law schools but, even then, there is no regularity as to when they are offered and no structure for a forensic concentration as a part of the J.D. curriculum.⁹

Part I of this article will describe the realities of the inextricable relationship between forensic science and the practice of law in our times. Forensic issues come up throughout the actual practice of law, primarily in civil and criminal litigation, but also in administrative proceedings and transactional work intended to avoid litigation. The judicial response to forensic evidence when it does go to court is often lethargic¹⁰ and tends to favor letting experts testify and not regulating the scope of their opinions.¹¹ The ultimate default is to let the jury decide what weight to give those opinions. While the concept of “gatekeeper” is familiar as a legal term,

6. The lawyers and judges, as end-users, convey the product to the litigants, juries and, ultimately, the public.

7. Michael J. Saks and David L. Faigman, *Failed Forensics: How Forensic Science Lost Its Way and How It Might Yet Find It*, 4 ANNU. REV. LAW SOC. SCI. 149, 161 (2008). (“Although law school could be described as a glorified liberal arts education it generally does not include courses in research methods and statistics. Even where such courses are available, they are taken by a small percentage of students.”)

8. See text below at ____.

9. See text below at ____.

10. Vosk, T., and Emery, A., FORENSIC METROLOGY: SCIENTIFIC MEASUREMENT AND INFERENCE FOR LAWYERS, JUDGES, AND CRIMINALISTS, CRC/Taylor Francis Group (2nd Edition, Supplement 2014) 1. (“Uncritical acceptance, ‘science-phobia’ and even lethargy have [led] to frequent reliance upon evidence that isn’t even good enough to be called wrong.”)

11. Gary Edmond, Simon Cole, Emma Cunliffe, and Andrew Robert, *Admissibility compared: The reception of incriminating expert opinion (i.e. forensic science) evidence in four adversarial jurisdictions*, 3 UNIVERSITY OF DENVER CRIMINAL LAW REVIEW 31, 99 (2013). (“It seems that judges rarely consider the probative value of incriminating expert opinion evidence, preferring to leave such issues for the tribunal of fact (and ‘weight’)”).

actual gatekeeping is often lacking.¹² Yet, because forensics is not taught at all or is available only as a sporadically offered elective in most law schools, lawyers come into the practice without adequate training to understand and litigate forensic issues. Since judges come from the ranks of lawyers in this country, the lack of law school education in forensics carries this deficit to the bench. And, to perpetuate the problem in an adversary system, lawyers who lack forensic education are unable to educate the judges.

Part II will explore the proposition that a paradigm shift is needed at the law school level in order to train lawyers and eventually judges about forensic science. The best minds in the forensic science community are dedicated to increasing the level of scientific rigor that goes into forensic investigations, reports and testimony. However, empirical evidence demonstrates that the level of rigor, advocated from the highest levels of the forensic science community, is often lost on the end users: the lawyers and judges.¹³ This perpetuates the presentation of scientifically unsound evidence in court which leads to wrongful convictions as well as unsupported judgments in civil and other court proceedings.

Part III will suggest that a curriculum be implemented in law schools to begin the process of systemic education in forensics for law students and will suggest the purpose of that curriculum. The purpose is not to train law students and lawyers to be forensic experts. The purpose is to train them sufficiently in the basic processes of science so that they can understand and identify fundamental forensics issues. This would enable them to work with forensic scientists and experts in the preparation and presentation of their cases. These end-users of forensic science – lawyers and judges – should be able to have intelligent discussions about the validity of scientific opinions and should be able to have robust discussions about admissibility and the scope of opinions offered by potential forensic witnesses.

Part IV will then outline a proposed structure for such a curriculum. It will begin with recommending a revamping of the basic evidence course offered to all students and will make recommendations for electives in forensics. It will then propose a concentration leading to a “certificate” in “forensic science and the law” that can be accomplished by the students as a part of their J.D. program. This is similar to existing concentrations in other areas like “business and the law” or “philosophy and the law” offered at

12. Paul C. Giannelli, *Forensic Science: Daubert's Failure*, 68 CASE W. RES. L. REV. 869 (2017). (Concluding that the “article examined the courts’ systemic failure in criminal cases to fulfill its “gatekeeper” function under *Daubert*.”)

13. See, Nat’l Research Council, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 53 (2009). (“For a variety of reasons—including the rules governing the admissibility of forensic evidence, the applicable standards governing appellate review of trial court decisions, the limitations of the adversary process, and the common lack of scientific expertise among judges and lawyers who must try to comprehend and evaluate forensic evidence—the legal system is ill-equipped to correct the problems of the forensic science community.”)

some institutions. The result would be to give law students who are considering careers in civil or criminal litigation the tools to deal with the inevitable and increasing utilization of forensic science in the courtroom. These lawyers will eventually become judges, and, in the meantime, they can educate current judges through proper forensic advocacy in the courtroom.

I. THE NEED

A. Prevalence of Forensic Evidence in Modern Litigation

Just about every case that comes before the court for litigation possesses the potential for forensic testimony and many cases realize that potential. Justice Stephen Breyer introduced the Third Edition of the federal *Reference Manual on Scientific Evidence* by saying,

In this age of science, science should expect to find a warm welcome, perhaps a permanent home, in our courtrooms. The reason is a simple one. The legal disputes before us increasingly involve the principles and tools of science. Proper resolution of those disputes matters not just to the litigants, but also to the general public—those who live in our technologically complex society and whom the law must serve. Our decisions should reflect a proper scientific and technical understanding so that the law can respond to the needs of the public.¹⁴

This article recognizes the progress being made by the leaders in forensic science to establish and enforce the highest standards.¹⁵ When we think of forensics we think of the collection and preservation of evidence from the scene or from the person of suspects or victims. We also think of the documentation of that evidence and crime scene procedures. We then think of the analysis and comparison of that evidence. The forensic evidence involved might involve fingerprints, impression evidence, hair and fiber evidence, trace (including glass, paint, and soil), firearms and toolmarks, biological evidence (including blood, bodily fluids and tissue), accelerants

14. NAT'L RESEARCH COUNCIL, COMMITTEE ON SCIENCE, TECHNOLOGY, AND LAW POLICY AND GLOBAL AFFAIRS, *REFERENCE MANUAL ON SCIENTIFIC EVIDENCE* 2 (3d ed. 2011).

15. See, e.g., Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 234 (2009). This commitment remains current despite the perceived push-back on forensic science by the federal government. Deputy Attorney General Rod Rosenstein, in a February 21, 2018 presentation to the American Academy of Forensic Sciences (AAFS), has made a full commitment on the part of the federal Department of Justice to support "ongoing practitioner led efforts to develop consensus-based and scientifically sound documentary standards." <https://www.justice.gov/opa/speech/deputy-attorney-general-rostenstein-delivers-remarks-american-academy-forensic-sciences>.

and flammable fluids, explosive material, questioned documents, drug evidence, bitemark and entomological evidence.¹⁶ There may also be wound identification, including wounds caused by gunshots, blunt force trauma, sharp trauma or other mechanisms in the emergency room¹⁷ or in the morgue.¹⁸ In vehicular accident or manslaughter investigations, there is accident reconstruction, interpretation of tire marks, calculation of speed from skids or crush, vehicle mechanics,¹⁹ as well as biomechanics.²⁰ Forensics is inextricably intertwined with the prosecutions that ensue. Homicide cases, child molest, rape, sexual assault, arson, robbery, burglary and other crimes against the person come to mind, as well as drunk driving and vehicular manslaughter.

Forensics also comes in to play in white collar criminal cases. There is forensic accounting, securities fraud analysis, computer analysis and examination of “big data.”²¹ Similarly, civil litigation also involves significant forensic evidence often of this same big data sort.²² In addition, civil litigation may involve scientific evaluation of product liability claims and construction cases that entail metallurgy, structural engineering, stress analysis, and physics and chemistry in general. Class actions and civil rights cases, for instance, may involve statistical analysis, including regression analysis and calculations of absolute and comparative disparities.²³

In both civil and criminal litigation law and forensic psychology intersect. Family law and probate matters, may include the testimony of forensic psychologists regarding best interests of children, competency, and commitment issues. In criminal cases, forensic psychologists and psychiatrists are called upon to evaluate competency to stand trial,

16. See, HENRY LEE, TIMOTHY PALMBACH, MARILYN MILLER, HENRY LEE’S CRIME SCENE HANDBOOK 131-182 (2001).

17. JONATHAN OLSHAKER, M. CHRISTINE JACKSON, WILLIAM SMOCK, FORENSIC EMERGENCY MEDICINE (2d ed. 2007).

18. VINCENT DiMAIO, SUZANNA DANA, HANDBOOK OF FORENSIC PATHOLOGY (2d ed. 2007).

19. See, Robert Rivers, TRAFFIC CRASH INVESTIGATOR’S MANUAL, Charles C. Thomas (2011).

20. See, Ronald L. Huston, FUNDAMENTALS OF BIOMECHANICS, CRC Press, Taylor and Francis (2013) passim, n.b. 366-369.

21. A.B.M Moniruzzaman and Syed Akhter Hossain, *NoSQL Database: New Era of Databases for Big data Analytics - Classification, Characteristics and Comparison*, 8 INT’L J. OF DATABASE THEORY AND APPLICATION (2013). (“Digital world is growing very fast and become more complex in the volume (terabyte to petabyte), variety (structured and un-structured and hybrid), velocity (high speed in growth) in nature. This refers to as ‘Big Data’ that is a global phenomenon.”).

22. Dru Stevenson and Nicholas J. Wagoner, *Bargaining in the Shadow of Big Data*, 67 FLA. L. REV. 1337 (2016).

23. See, e.g., David H. Kaye & David A. Freedman, *Reference Guide on Statistics*, NAT’L RESEARCH COUNCIL, COMMITTEE ON SCIENCE, TECHNOLOGY, AND LAW POLICY AND GLOBAL AFFAIRS, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 2 (3d ed. 2011) and, Daniel L. Rubinfield, *Reference Guide on Multiple Regression*, Id. 303.

diminished capacity, and insanity²⁴ Increasingly, attention is being turned to cognitive neuroscience and brain development,²⁵ for instance, relating to criminal culpability²⁶ and witness credibility.²⁷

In these and other case, there may be an issue of quantifying the results by way of frequentist, random match probability, likelihood ratios, Bayesian analysis, conditional probability tables, or even more complex analyses such as Bayesian networks or acyclic graphical probability models. The National Institute of Science and Technology (NIST) has established five committees and twenty five subcommittees representing the areas of scientific inquiry likely to be involved in forensic analysis. They are: The Biology/DNA Committee, including subcommittees for Biological Data & Reporting, Biological Methods, and Wildlife Forensics; the Chemistry/Instrumental Analysis Committee, including subcommittees for Fire Debris & Explosives, Geological Materials, Gunshot Residue, Materials (Trace), Seized Drugs, and Toxicology; the Crime Scene/Death Investigation Committee, including subcommittees for Anthropology, Crime Scene Investigation, Disaster Victim Identification, Dogs & Sensors, Fire & Explosion Investigation, Medicolegal Death Investigation, and Odontology; the Digital/Multimedia, Digital Evidence Committee, including subcommittees for Facial Identification, Speaker Recognition, and Video/Imaging Technology & Analysis; and the Physics/Pattern Interpretation Committee including subcommittees for Bloodstain Pattern Analysis, Firearms & Toolmarks, Footwear & Tire, Forensic Document Examination, and Friction Ridge.²⁸ And, there are new, nuanced and ever-expanding areas in which forensic science will continue to enter the courtroom.²⁹

24. See, Marc Ackerman, *ESSENTIALS OF FORENSIC PSYCHOLOGICAL ASSESSMENT*, John Wiley & Sons (2nd ed. 2010).

25. Lyn M. Gaudet & Gary E. Marchant, *Under the Radar: Neuroimaging Evidence in the Criminal Courtroom*, 64 *DRAKE L. REV.* 577 (2016).

26. Casey, B J. *et al.*, *How Should Justice Policy Treat Young Offenders?* PENN. LAW: LEGAL SCHOLARSHIP REPOSITORY, 1744 (2017).

27. Francis X. Shen, *et al.*, *The Limited Effect of Electroencephalography Memory Recognition Evidence on Assessments of Defendant Credibility*, 4 *J.L. & BIOSCIENCES* 330-364 (2017).

28. See, THE ORGANIZATION OF SCIENTIFIC AREA COMMITTEES FOR FORENSIC SCIENCE: OSAC ORGANIZATIONAL STRUCTURE, <https://www.nist.gov/topics/forensic-science/osac-organizational-structure> (last visited Apr. 8, 2019).

29. From recent literature, see, for instance, Mauro Conti, Ali Dehghantanha, Katrin Franke, Steve Watson, *Internet of Things security and forensics: Challenges and opportunities*, 78 *FUTURE GENERATION COMPUTER SYSTEMS*, Part 2, 544-546 (January 2018); or J. Wang, T. Li, Y.Q. Shi, *et al.*, *Forensics feature analysis in quaternion wavelet domain for distinguishing photographic images and computer graphics*, 76 *MULTIMED TOOLS APPL* 23721 (2017); or Ning Liu, Lichao Zhang and Chuntao Chen, *A Preliminary Study on Sources of Banding Artifacts for the Identification of Monochromatic Laser Printers*, 62 *JOURNAL OF FORENSIC SCIENCES* 1556 (March 2017).

B. Judicial Approaches to Forensic Evidence

The indisputable fact is that forensic science is ubiquitous in litigation, both criminal and civil, and the reliance on forensic evidence is increasing. The leaders in forensic science have been attempting to increase the level of science in forensic science.³⁰ Unfortunately, the end users of this forensic science are the lawyers and, ultimately, the judges who allow juries to hear or not hear the evidence. This is where the best intentions of the leaders in forensic science are thwarted. If judges do not do their job in gatekeeping, there is nothing to distinguish between “good” science and sub-standard science.³¹ Regrettably, sub-standard science is always available for a price.³²

It is established that judges are only minimally more effective in understanding science than average jurors.³³ There have been efforts to educate judges, including efforts by the federal Judicial Council³⁴ and state courts. Unfortunately, judges do not have to attend these programs. Article III judges are appointed for life.³⁵ Most state judges are elected or stand for

30. See, e.g., David H. Kaye, “Hypothesis Testing in Law and Forensic Science,” 130 HARV. L. REV. FORUM 127.

31. We will use the term “substandard science” to describe forensic investigations, analyses, reports and testimony that do not meet the criteria of *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993) and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), rather than the more pejorative term “junk science.” We will also use the term “science” or “forensics” whether it is “science” or “expertise” in light of the Court’s recognition in *Kumho Tire* that the same fundamental considerations apply, even if applied more flexibly, to non-science expertise. Ultimately, as to all forensic opinions, the Supreme Court in *Kumho Tire* has relied on FED. RULE OF EVID. 702 and has held, “The objective of that [the Daubert gatekeeping] requirement is to ensure the reliability and relevancy of expert testimony. It is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.” *Id.* at 152.

32. See, e.g., Peter Huber, GALILEO’S REVENGE: JUNK SCIENCE IN THE COURTROOM, Basic books (1991) for one of many venerable accounts; and, e.g., Edward J. Imwinkelried, *The Best Insurance against Miscarriages of Justice Caused by Junk Science: An Admissibility Test that is Scientifically and Legally Sound*, UC Davis Legal Studies Research Paper Series, at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3035644, for a contemporary expression of concern.

33. See, e.g., Sophia Gatowski, Shirley Dobbin, James Richardson, Gerald Ginsburg, Mara Merlino, and Veronica Dahir, *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*, 25 LAW & HUMAN BEHAVIOR 433 (2001) (The authors conducted a two-part survey of 400 state court judges – with a 71% and 81% response rate respectively—in which only four percent of respondents could operationalize *Daubert*’s falsifiability and error rate factors).

34. Among dozens of full training sessions and dozens of seminars, two seminars are currently offered to federal judges on science issues: Law and Biosciences and Law and Neuroscience. See, *Programs and Resources for Judges*, at: <https://www.fjc.gov/education/programs-and-resources-judges#SF>.

35. UNITED STATES CONST., ART. I, SEC. 1 (“The judicial power of the United States, shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish. The judges, both of the supreme and inferior courts, shall hold their offices during good behaviour, and shall, at stated times, receive for their services, a compensation, which shall not be diminished during their continuance in office.”)

retention elections and are relatively autonomous in how they do their jobs.³⁶ Hence, none of the judges are required to attend forensic science education and few do.³⁷ Whether that is the best way to handle matters or not, it is the case that once a judge, the choice to pursue further education is optional. And time is not on the side of the judiciary. Science itself is progressing at an exponential rate and, overlaid on that, the leaders of forensic science are increasing the standards for forensic investigation, reports and testimony. Most likely, 20, 30, 40, or even 50 years ago, when the judges were in law school, there was little or no education in forensics available to the J.D. candidate.³⁸

There are certainly some judges who have a command of and concern about forensic science and forensic evidence.³⁹ Jed Rakoff, a senior judge on the Federal District Court for the Southern District of New York, has been the author of several opinions regarding forensic testimony⁴⁰ and he teaches forensic at Columbia Law School.⁴¹ He is in the minority of federal judges, and the distinct minority of trial judges of all jurisdictions, who has seriously studied forensics. As a result, he is one of the more vocal jurists in his concern over the lack of appreciation of the subject by judges and lawyers. He has said: “Like aliens from outer space, then, science has invaded the courtroom. This is hardly surprising, given the increasing importance of science and technology in our society. Nevertheless, judges frequently find it difficult, and sometimes bewildering, to come to grips with science in the courtroom.”⁴²

36. See discussion of State Court programming for judicial education in Duane Benton and Jennifer A.L. Sheldon-Sherman, *What Judges Want and Need: User-Friendly Foundations for Effective Judicial Education*, 2015 J. DISP. RESOL. 28-30 (2015).

37. See, Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* (2009) 234. (“However, these courses are not mandatory, there is no fixed routine of continuing education in legal practice with regard to science, and there are no good ways to measure the proficiency of judges who attend these programs.”)

38. According to the Federal Judicial Center, the average age of federal Article III judges is in the range of 68 years old. <https://www.fjc.gov/history/exhibits/graphs-and-maps/age-and-experience-judges>. Assuming that the judges graduated from law school at the age of between 25 and 30, their attendance at a law school evidence class would have been approximately 40 to 45 years ago. (Please excuse the apparent ageism; the present author took evidence in 1971—47 years ago—and graduated from law school in 1973.)

39. See, e.g., Judge Stephanie Domitrovich, *Judges as Gatekeepers of Science and the Law: The Importance of Judicial Education*, THE JUDGE'S JOURNAL (ABA JUDICIAL DIVISION), NO. 4, 1 (Sept. 2017) and accompanying articles in that issue which is entitled, *Judicial Education and the Sciences*.

40. See, e.g., *Almeciga et al v. Center for Investigative Reporting, Inc. et al*, No. 1:2015cv04319 - Document 99 (S.D.N.Y. 2016) for an excellent discussion of forensic abuse where Judge Rakoff strikes the plaintiff's handwriting expert's testimony and considers Rule 11 sanctions against the plaintiff's lawyers.

41. Judge Rakoff was also a member of the prestigious and now dissolved (by Attorney General Sessions) Commissioner on the National Commission on Forensic Science and he served as co-chair of the National Academy of Science's Committee on Eyewitness Identification.

42. Jed Rakoff, *Science and the Law: Uncomfortable Bedfellows*, 38 SEATON HALL LAW REVIEW 1379, 1380 (2009).

The Reference Manual on Scientific Evidence, published by the federal Judicial Council, observes that, while there is some progress in litigating foundational issues in civil cases, prosecution evidence, in particular, is often admitted in criminal cases with less scrutiny. It states:

Also, as judges write more sharply focused opinions in civil cases, the very different approach they use in criminal cases stands out in vivid contrast. Supposedly, the federal rules are trans-substantive, and it is certainly arguable that errors that bear on life and liberty should weigh more heavily than errors in civil cases concerned primarily with money. To date, however, few prosecution experts have been excluded as witnesses in criminal prosecutions. Usually judges have allowed them to testify or, at most, have curtailed some of the conclusions that prosecution experts sought to offer. [footnotes omitted]⁴³

In general, the judicial response to forensic evidence, particularly when offered by the prosecution in criminal cases, is lethargic and tends to favor letting experts testify and not to regulate the scope of the experts' opinions. The all too common judicial ruling is to let the evidence come in and to let the jury decide what weight to give that evidence.⁴⁴ To the contrary, the law is that the judge must act as the "gatekeeper."⁴⁵ To simply rule as a default that the evidence is admitted, and that any objections go to the weight not admissibility, is to abdicate the duties of gatekeeper. The result of this default approach is that, sub-standard science gets admitted along with valid science. The efforts of the leaders of forensic science who are trying to be faithful to the commitments of science are thwarted by the admission of substandard science as if it were equivalent to their more disciplined work.

43. National Research Council, Committee on Science, Technology, and Law Policy and Global Affairs, *REFERENCE MANUAL ON SCIENTIFIC EVIDENCE* THIRD EDITION National Academies Press, 27 (2011). See also, Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 11 (2009). "Although it is difficult to get a clear picture of how trial courts handle *Daubert* challenges, because many evidentiary rulings are issued without a published opinion and without an appeal, the vast majority of the reported opinions in criminal cases indicate that trial judges rarely exclude or restrict expert testimony offered by prosecutors; most reported opinions also indicate that appellate courts routinely deny appeals contesting trial court decisions admitting forensic evidence against criminal defendants. [footnote omitted]." See also, Peter J. Neufeld, *The (Near) Irrelevance of Daubert to Criminal Justice and Some Suggestions for Reform*, 95 AM. J. PUB. HEALTH S107 (2005).

44. Gary Edmond, Simon Cole, Emma Cunliffe, and Andrew Robert, *Admissibility compared: The reception of incriminating expert opinion (i.e. forensic science) evidence in four adversarial jurisdictions*, 3 UNIVERSITY OF DENVER CRIMINAL LAW REVIEW 31, 99 (2013). ("It seems that judges rarely consider the probative value of incriminating expert opinion evidence, preferring to leave such issues for the tribunal of fact (and 'weight')").

45. This is certainly true in *Daubert* jurisdictions but all states in the United States have rules of evidence that require some foundational determination on admissibility by the court. Paul C. Giannelli, *Forensic Science: Daubert's Failure*, 59 CASE W. RES. L. REV. ____ (forthcoming),

Therefore, the leaders of the forensic community, as represented by the American Academy of Forensic Sciences (AAFS), for instance, can make progress among those committed to the highest standards of forensics but cannot impose those standards on everyone who is willing to testify. That job is left to the lawyers and the judges. Only they can keep substandard science out of the courtroom. And, yet, the National Academy of Sciences in their 2009 Report said:

The judicial system is encumbered by, among other things, judges and lawyers who generally lack the scientific expertise necessary to comprehend and evaluate forensic evidence in an informed manner, trial judges (sitting alone) who must decide evidentiary issues without the benefit of judicial colleagues and often with little time for extensive research and reflection, and the highly deferential nature of the appellate review afforded trial courts' *Daubert* rulings."⁴⁶

The further question is how – if the, at least current, bench is not likely to pursue their own continuing education in forensics – can judges be educated in individual cases that come before them? While exhortation to the judicial call of duty may have some effect, it is not likely to solve such a pervasive problem.⁴⁷ The answer is that the lawyers appearing before the judges have to be educated and, in turn, those lawyers have to be prepared to educate the judges. In fairness, that is what the adversarial system is designed to do. The lawyers study their cases and come to court prepared to educate the judge about all aspects of their cases, including the law and the facts. Judges are “generalists.”⁴⁸ For the most part, trial judges do not specialize in any part of the law or area of expertise. They rightfully expect the lawyers for the litigants to be prepared and to guide them and answer and difficult questions.

Forensic evidence is no different than any other type of legal or factual question that is presented to the court. Before forensic evidence can be

46. Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 12 (2009).

47. See, e.g., Stephanie Damon-Moore, *Trial Judges and the Forensic Science Problem*, 92 N.Y.U. L. Rev. 1532 (2017) (An excellent job of describing the problem but concluding, “Trial judges are uniquely well positioned to staunch the flow of unreliable forensic evidence into court, which will both prevent wrongful convictions and inspire scientific research to validate or improve forensic disciplines. In order to do so, however, trial judges must break with sometimes-lengthy histories of admission, engage in a technical analysis outside the wheelhouse of most lawyers, and perhaps even face political backlash against an unpopular decision. As difficult as this may seem, none of the obstacles facing trial judges are insurmountable, and none exempt trial judges from their obligation to vigilantly gatekeep expert evidence in their courtrooms.”)

48. National Research Council, Committee on Science, Technology, and Law Policy and Global Affairs, *REFERENCE MANUAL ON SCIENTIFIC EVIDENCE THIRD EDITION* National Academies Press (2011) 4. (“Judges typically are generalists, dealing with cases that can vary widely in subject matter.”)

admitted by an offering party, the opposing counsel can request a motion *in limine*.⁴⁹ There, the proponent has the obligation to establish the foundational facts for the admission of the evidence and to justify any proposed opinion to be offered by the witness before the jury. Of course, a judge can still throw up her hands and abdicate the responsibility to “keep the gate” but, properly educated lawyers can insist that the trial judges – and on appellate review, the appellate judges – do their gatekeeping job.

Unfortunately, lawyers, to this day, are not getting the forensic education that they need to deal with this ubiquitous type of evidence. Just as it is unrealistic to expect exhortatory measures alone to reverse the process of judicial lethargy, it is unlikely that exhortatory measures will have that much effect on practicing lawyers. Again, a dedicated and informed minority of judges and lawyers will continue to pursue their own education in forensics but the majority – those who have not – probably will not. Therefore, a change at the root of legal education, the JD program, would seem to be most effective systemically.

C. Forensics in the Law School

Forensics is not taught at all or is available only as an elective in most law schools.⁵⁰ Certainly, some law schools have made efforts to include forensics in the curriculum in an unstructured fashion.⁵¹ One law school offers an LL.M Program in Forensics⁵² and several have joint degree programs.⁵³ However, in most law schools, despite the fact that forensics will

49. FED. RULE OF EVIDENCE 104” “(a) In General. The court must decide any preliminary question about whether a witness is qualified, a privilege exists, or evidence is admissible. . . . “(b) Relevance That Depends on a Fact. When the relevance of evidence depends on whether a fact exists, proof must be introduced sufficient to support a finding that the fact does exist.”

50. Based on the author’s extensive review of law school curricula and discussion with forensic scholars and law professors over the last few years through organizations including, AAFS and COFSE.

51. For instance, Harvard Law School offers a “Program of Study” in Law, Science, and Technology, which includes some classes on forensics. The University of California system has “concentrations” at the various campuses but, despite the leading work in the field like that of Professors David Faigman (Hastings), Andrea Roth (Berkeley) and Edward Imwinkelried (Davis), there are classes at some UC institutions but no concentrations. Jed Rakoff offers a class in forensics at Columbia. Barry Scheck and Peter Neufeld created the first Innocence Project and it is run in conjunction with Cardozo Law School, with law schools around the United States (including Puerto Rico) and Canada participating as members of the Innocence Network. Again, there are classes and some clinical programs but no formal concentration.

52. The West Virginia University College of Law is the first and only institution to offer an LL.M in Forensics; see, <https://www.law.wvu.edu/home/llm/online-llm-forensic-justice>. This is admirable but, of course, is a post J.D. program.

53. Programs, such as the John Jay College of Criminal Justice offer a joint degree program, there granting an M.A. in Forensic Psychology along with a J.D. at the CUNY Law School; see, <http://jjay.smartcatalogiq.com/en/2017-2018/Graduate-Bulletin/Degrees-Offered/Forensic-Psychology-and-Law-MA-JD-CUNY>. A number of other schools provide the potential for a joint degree program in forensics resulting in an MA, MS or PhD along with the J.D..

factor into most kinds of cases that the students will be handling as lawyers, it is possible to go through the entire J.D. program and have no more than the briefest introduction to general concepts of forensics. Furthermore, there is no institutional incentive to take on a concentration in law and forensics as a part of the J.D. When looking at the J.D. curriculum, educators and accreditation bodies need to take a hard look at whether forensic education should be a key part of what is required to produce competent practitioners.

At the present, the only *required* class in which forensic evidence may be systematically addressed is evidence.⁵⁴ The subject of forensic science may come up tangentially in torts, criminal law, criminal procedure or even contracts. However, in these contexts, the science and the admissibility are generally not the focus of the teaching and forensics is incidental to understanding a case that illustrates some other substantive principle of law. So, the official required training that a lawyer receives is limited to that small portion of evidence class.

If we look at a typical current class on evidence, we see that something related to forensics is scheduled to receive a small percentage of the entire class.⁵⁵ As a comparison, forensics receives about one third to one fifth the attention given to hearsay alone.⁵⁶ This level of attention is reflected in the typical course books.⁵⁷ There is no question that hearsay is intellectually interesting. Hearsay also provides almost endless material for the invocation of the Socratic pedagogical technique. It is a traditional part of the law school curriculum and may be hard to move away from. However, the

54. Not all law schools require a class in evidence as a requirement for a J.D..

55. See, e.g., Paul Rothstein, *Teaching Evidence*, 50 ST. LOUIS U. L.J. 999 (2006); Professor Rothstein, a Professor at Georgetown, teaches a fourteen-week course, two meetings a week, in which he emphasizes the “four pillars of evidence (relevancy, counterweights to relevancy, hearsay and privilege).” Id. at 1003. Professor Rothstein gives a rare a week by week recitation of his evidence course and says that he gets to FEDERAL RULES OF EVIDENCE 701-706 in week nine but does not discuss “Scientific-Type Experts” until week ten at which point it is a quick run through film clips, discussions of *Frye* and *Daubert* and discussions of types of broader issues raised by expert testimony. Id. at 1020-1021. Therefore, one of fourteen weeks is spent on forensics.

56. See, e.g., Peter Murray, Syllabus, Harvard Law School (Fall Semester, 1999), six class sessions for hearsay and two for opinions and expert testimony, at: http://www.law.harvard.edu/publications/evidenceiii/syllabi/hls_fall_99.html. Steve Emens, University of Alabama Law School (Fall Semester 2017), five full weeks on hearsay and one week on expert witnesses out of a 13 week course, at: <https://www.law.ua.edu/courseguide/files/syllabi/2017-Fall-6-001385.pdf>. Professor Rothstein, above, teaches one week of forensics compared to four weeks of hearsay. Rothstein, *Teaching Evidence*, 50 St. Louis U. L.J. 999 at 1021-1037 (2006)

57. See, e.g., Roger Park and Richard Friedman, EVIDENCE, CASES AND MATERIALS, 12TH EDITION, Foundation Press (2013). Expert opinion and scientific evidence share Chapter 11, the last chapter, with scientific evidence comprising 110 pages. Id. 852-962. Whereas hearsay is in Chapter 3 and comprises almost 300 pages. Id. 197-484; see also, Jack Weinstein, Norman Abrams, Scott Brewer, Daniel Medwed, EVIDENCE, CASES AND MATERIALS, 10TH EDITION (2017); hearsay 420 pages (Id. 549-964) and expert testimony 180 pages (Id. 1155-1336). A Teachers Manual for a 2017 Evidence book (confidential material for law professors only, on file with author) dedicates 40 pages to hearsay and only 7 pages to expert opinion and testimony.

traditional law school curriculum is being re-thought.⁵⁸ One aspect of that curriculum, hearsay, in particular has been identified as a possible area to streamline traditional teaching in favor of proceeding more efficiently.⁵⁹

Without focusing unnecessarily on the need, or lack thereof, to streamline the hearsay portion of evidence class or streamline other aspects of the overall J.D. curriculum, the fact is that forensic science needs to have a more prominent role in required course work. Forensics is an important part of the law and becoming more important each year. It is not sufficient to say that only litigators should be trained in forensics since legal education in this country is designed to give to least basic training in all major areas of law to all students.⁶⁰ The subject of evidence is taught as a core curriculum class because, to be a lawyer, one should to be prepared to engage in litigation or at least be able to understand the broad principles of potential litigation. Criminal law, criminal procedure, and civil procedure are required for the same reason even if a student may never intend to practice in the courts. Just as, for people who intend to be litigators, a background in business associations, contracts and family wealth is still considered important, an education in forensics should be part of the core curriculum.

Given the likelihood that a lawyer will confront forensic issues in one aspect or another in the practice of law, whether in litigation or transactional practice, it would seem that training in forensics today would be at least as important as requiring education in hearsay. On that measure, law schools are failing to provide the necessary education in this important area of law. That, in turn, is perpetuating the lack of understanding on the part of the judges. They likely neither obtained a forensic education themselves as law students nor are they receiving in service training and they are not being educated by lawyers who argue cases before them.

II. THE ASCENT OF SCIENCE IN FORENSIC SCIENCE

A. *The FBI, DOJ, SWG's, NAS, NIST, OSACs, AAFS, and FEPAC*

The best minds in the forensic science community are dedicated to increasing the level of scientific rigor that goes into forensic investigations, reports and testimony. The American Academy of Forensic Sciences

58. Daniel B. Rodriguez, *Legal Education and Its Innovations*, 13 FIU L. Rev. 199 (2018).

59. Even the newer texts that take a different approach to teaching evidence may streamline hearsay but do little to increase the attention given to forensic evidence. See, e.g., Richard Lempert, Samuel Gross, James Liebman, John Blume, Stephan Landsman, Frederic Lederer, *A MODERN APPROACH TO EVIDENCE: TEXT, PROBLEMS, TRANSCRIPTS AND CASES* 5TH EDITION (2014).

60. As Professor Rothstein put it, evidence is important to the education of all lawyers because, "Rights are not rights without proof, and a careful lawyer always has an eye on what can be proved." Paul Rothstein, *Teaching Evidence*, 50 ST. LOUIS U. L.J. 999, at 1000 (2006).

(AAFS), formed in 1948, has been a leader in the United States in the advancement of forensic standards and education.⁶¹ AAFS sponsors the Forensic Science Education Programs Accreditation Commission (FEPAC) whose mission it is to maintain and to enhance the quality of forensic science education through a formal evaluation and recognition of college-level academic programs.⁶² Also, affiliated with AAFS is the Council of Forensic Science Educators (COFSE). It is another organization dedicated to education of students of forensics. Their emphasis also is on college and graduate student education and they even have a group interested in promoting high school students to pursue careers in forensics.⁶³ However, none of these organizations specifically promotes forensic education as a part of the JD program in law schools.⁶⁴

Nevertheless, the emphasis of AAFS, FEPAC and COFSE, as non-governmental organizations, is to promote science as the backbone of forensics. There are also non-governmental professional organizations that promote these interests along with the interests of their members.⁶⁵ Some of these professional organizations are more dedicated to the advancement of actual science and others appear more dedicated to the preservation of the guild. Nevertheless, many of these organizations have promulgated aspirational goals for professionalism by way of codes of ethics, standards and best practices.

Meanwhile, there has been a movement in law enforcement itself to enhance the professionalism and reliability of forensic investigations, opinions, reports and testimony. For decades, law enforcement fostered its own mystic by supporting forensic specialists and laboratories whose conclusions were often unchallenged. The Federal Bureau of Investigation (FBI) as a part of the Department of Justice (DOJ) created a crime laboratory that was as famous as that of Scotland Yard. Their firearm collection was extensive, and they were able to relate class characteristics of projectiles to groups of potential firearms. They started to amass fingerprints and criminal records. But, while doing this, they also engaged in less scientific programs like profiling and, eventually, bullet lead content analysis, gunshot residue

61. See, American Academy of Forensic Sciences, <https://www.aafs.org/>.

62. See, Forensic Science Education Programs Accreditation Commission, <http://www.fepac-edu.org/>.

63. See, Council of forensic Science Educators, <https://cofse.org/>.

64. AAFS has a Jurisprudence Section and COFSE has formed a working group under their Higher Education Committee to start evaluating support for a law school education program. The author is a member of both and Chair Pro Tem of the COFSE Subcommittee on Forensic Education in the JD Program. However, to date, there is no formal program to stimulate forensic education in law schools or provide accreditation of the sort FEPAC provides to graduate schools and, though the interest is encouraging, COFSE is just beginning its exploration of the subject.

65. For instance, the Association of Firearms and Toolmarks Examiners (AFTE), the National Association of Fire Investigators (NAFI), the National Association of Medical Examiners (NAME), the American Board of Forensic Toxicology (ABFT) and others.

analysis, shoe print comparisons, hair comparisons⁶⁶ and bite-mark evidence. The luster started to wear off in the 1980's when it was established that some of the work they claimed solved crimes was deficient. The first big issue to get national attention was lead analysis.

As a result, the FBI and DOJ decided to reach outside the FBI laboratory to other experts in the various fields. They created Scientific Working Groups (called SWGs) for each of the major forensic disciplines.⁶⁷ The idea was to have actual scientists evaluate whether what they were doing was actually based on science and to create standards for investigations, analysis, opinions, report writing and testimony. After being created, the SWGs had varying degrees of success in meeting these goals. Some of them simply became extensions of the professional organizations that were protecting the guilds from criticism. Some did not promulgate any standards or only superficial ones. Others took the job seriously and looked critically at what had passed for science and what standards and best practices should be followed to make their field of forensics more scientific.

Of course, as this process proceeded through the 1990's a 2000's, the forensic community and people associated with it in law enforcement and the courts came in for a rude awakening. The ability of DNA testing to exonerate people who were innocent and wrongfully convicted demonstrated conclusively that forensics was not doing its job. In an early but leading study, 60% of the cases of trials that involved innocent defendants who were wrongfully convicted, forensic analysts called by the prosecution offered invalid testimony at trial.⁶⁸ The Congress of the United States at the urging of the Attorney General under George W. Bush appointed the prestigious National Academy of Sciences (NAS) to conduct a study of the state of forensic science in the United States.⁶⁹ The NAS convened a stellar group and took testimony over a period of years. In 2009, they issued their now

66. Federal Bureau of Investigation, News, *FBI Testimony on Microscopic Hair Analysis Contained Errors in at Least 90 Percent of Cases in Ongoing Review*, (April 20, 2015) <https://www.fbi.gov/news/pressrel/press-releases/fbi-testimony-on-microscopic-hair-analysis-contained-errors-in-at-least-90-percent-of-cases-in-ongoing-review>.

67. Eight Scientific Working Groups were formed by the FBI in the 1990's "to improve discipline and build consensus" in the forensic community: SWGDAM—DNA Analysis; SWGDE—Digital Evidence; SWGDOC—Questioned Documents; SWGFAST—Latent Fingerprints; SWGGUN—Firearms and Toolmarks; SWGIBRA—Illicit Business Record; SWGIT—Imaging Technologies; SWGMAT—Materials. See archived page: <https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/july2000/swgroups.htm>.

68. Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 VA. L. REV. 1, 14-16 (2009); ("This study found that in the bulk of these trials of innocent defendants – 82 cases or 60% – forensic analysts called by the prosecution provided invalid testimony at trial – that is, testimony with conclusions misstating empirical data or wholly unsupported by empirical data.") *Id.* at 2.

69. P.L. NO. 109-108, 119 STAT. 2290 (2005).

famous report, *FORENSICS: THE PATH FORWARD*,⁷⁰ which was devastatingly critical of just about all areas of forensics as practiced with the exception of single source non-contaminated DNA analysis.⁷¹

This report led to several changes. For one, it was recommended that forensics not be under the control of law enforcement or law enforcement agencies.⁷² This had been recognized by some, such as the National Association of Medical Examiners (NAME), even though many medical examiners were pathologists employed by law enforcement in places throughout the country.⁷³ It was resisted by others where the “crime lab” was an integral part of law enforcement. However, the NAS report concluded that science could not be coopted or appear to be coopted by law enforcement. It had to be a search for scientific “truth,” not results that were a product of partisan advocacy.

The SWGs were, of course, sponsored by the DOJ and the FBI. As a result, to get forensics out from under the supervision of law enforcement, the National Institute of Standards and Technology (NIST), under the Department of Commerce, was designated as the lead forensic agency for the United States government for the purposes of improving and supervising forensic science. NIST then created the Organization of Scientific Area Committees (OSAC).⁷⁴ The DOJ was reluctant to give up its position in charge of the FBI laboratory and its indirect influence on the SWGs.⁷⁵ As a result, the National Commission on Forensic Science (NCFS), under the supervision of the DOJ, was formed in 2013 to “partner” with NIST and oversee the work of the OSACs.⁷⁶ Meanwhile, the DOJ itself created proposed guidelines for forensic opinions.⁷⁷ NIST awarded a \$21 million

70. NAT'L RESEARCH COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (2009).

71. *Id.* at 127-133.

72. *Id.* at 17-19.

73. Judy Melinek, *et al.*, *National Association of Medical Examiners Position Paper: Medical Examiner, Coroner, and Forensic Pathologist Independence*, POSITION PAPERS, (March 2013) at https://www.thename.org/index.php?option=com_content&view=article&id=32:name-public-position-papers&catid=20:site-content&Itemid=122.

74. John M. Butler, *The National Commission on Forensic Science and the Organization of Scientific Area Committees*, PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HUMAN IDENTIFICATION (2014) at: <https://www.nist.gov/sites/default/files/documents/forensics/Butler-ISHI-Proceedings2014.pdf>.

75. See, e.g., SWGGUN “Requirements/Recommendations,” at https://www.nist.gov/sites/default/files/documents/2016/11/28/swggun_systemic_report.pdf.

76. For a history of the NCFS up to the date that Attorney General Sessions allowed its charter to expire, see, National Commission on Forensic Science: Reflecting Back—Looking toward the future, (NIST, April 11, 2017).

77. Despite closing down the NCFS, the DOJ, primarily under the leadership of Rod Rosenthal, approved final “Uniform Language for Testimony and Reports” during 2018 and 2019 based on tentative drafts sent out during the prior administration in summer of 2016. See 2016 drafts at <https://www.justice.gov/archives/dag/departement-justice-proposed-uniform-language-documents-fiber->

grant administered by Iowa State University to create the Center for Statistics and Applications in Forensic Evidence (CSAFE) and study the feasibility of quantifying forensic opinions.⁷⁸ And President Obama directed the President's Council of Advisors on Science and Technology to report on the status of forensics.⁷⁹

B. Developing Standards

This is not the place to chronicle all of the developments in forensics as a result of all this activity on the part of NGO's and government organizations. To summarize some of the high points, many areas of forensics have fallen from grace, such as toolmark and bite-mark evidence⁸⁰, hair comparisons⁸¹ and others. Additional areas have been found to be wanting and, according to the PCAST report⁸² and the NAS report,⁸³ only DNA analysis, particularly of single donor, non-degraded, uncontaminated samples, is not subject to significant criticism. The SWGs that promulgated standards (which was not all of them), individual professional organizations, the NAS and PCAST, the DOJ and AAFS through its Academy Standards Board Consensus Bodies reporting to the American National Standards Institute (ANSI), have all suggested best practices that did not exist even a few years ago.⁸⁴

Some of these standards set forth new requirements as a foundation for offering opinions. These requirements include black box studies, proficiency studies, peer review, laboratory standards, and laboratory accreditation. As framed by the PCAST Report, scientific criteria for validity

footwear-and-tire-treads-general; see, final "Uniform Language" documents finalized in 2018 and 2019 at <https://www.justice.gov/olp/uniform-language-testimony-and-reports>.

78. See, <http://forensicstats.org/>; see also, *Iowa State to be home to a new, \$20 million national center for forensic science*, Iowa State U. News Service (May 25, 2015), <https://www.news.iastate.edu/news/2015/05/25/forensicsciencecenter>.

79. Executive Office of the President, President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*, (Sept., 2016), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf.

80. Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* (2009) at 42.

81. *Id.* at 155-161.

82. Executive Office of the President, President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*, (Sept., 2016), at 2; ("DNA analysis of single-source samples [has] become the "gold standard" of forensic science for both investigation and prosecution.")

83. Nat'l Research Council, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* (2009) at 127-133.

84. See AAFS, ASB webpages at <https://www.asbstandardsboard.org/>; see, e.g., the ANSI/ASB Wildlife Forensics Standards at <http://www.asbstandardsboard.org/published-documents/wildlife-forensics-published-documents/>

and reliability has to be established in each field. This means that there must be criteria met to establish “foundational validity” and “validity as applied.”⁸⁵

An even bigger departure from prior practices is the revision of the manner in which forensic opinions can be expressed. This is a significant improvement to bring forensics closer to the standards of actual scientific research. Basically, it has been said across the board that comparative evaluations cannot use the terms like:

“To a reasonable degree of scientific certainty.”

“To a reasonable degree of medical certainty.”

“It is a match.”

“It is identical.”

“This identifies the defendant.”

“This supports the plaintiffs’ theory of the case.”

“The defendant’s conduct caused the injuries.”

“Based on my training and experience, I can see....”⁸⁶

But beyond this, there is now a movement to quantify forensic opinions once robust data bases can be developed. This would result in findings expressed in frequencies, random match probabilities, likelihood ratios, Bayesian analysis and Bayesian networks. It is happening in Europe⁸⁷ and is being reintroduced as a possibility in the United States through, among other things, NIST, NIJ and the CSAFE program at Iowa State, University of Virginia, University of California at Irvine, and Carnegie-Mellon University.⁸⁸

What all this means to lawyers is that investigation, analyses, opinions, reports and proffered testimony all are subject to review by the court to determine what, if anything is admissible. This is where lawyers have to be able to file and litigate motions *in limine* and to be able to educate judges as to the standards. Lawyers therefore have to have a basic understanding of what to look for in the work of the forensic experts and what sort of thing constitutes a valid science, a qualified scientist in that area of science, a legitimate body of data that is reliable and an opinion based on what a real

85. Executive Office of the President, President’s Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*, (Sept., 2016), at 47-59.

86. Martin Enserink, *Evidence on Trial*, 351 SCIENCE MAGAZINE 1128, 1129-1132 (Mar., 2016) (summarizing the current emerging standards at the highest levels of forensics).

87. See, Yvonne McDermott and Colin Aitken, *Analysis of evidence in international criminal trials using Bayesian Belief Networks*, 16 LAW, PROBABILITY AND RISK, 111-129 (2017); See also, Arthur Dyevre, Wessel Wijtvliet, Nicolas Lampach, *The Future of European Legal Scholarship: Empirical Jurisprudence*, LEUVEN CENTRE FOR LEGAL THEORY AND EMPIRICAL JURISPRUDENCE (2017).

88. See, <http://forensicstats.org/>.

scientist would say about reliable data based on the proper application of the real science.

C. *What Gets By the Gate Harms Everyone*

Empirical evidence demonstrates that the level of rigor, advocated from the highest levels of the forensic science community, is often lost on the end users: the lawyers and judges.⁸⁹ This perpetuates the presentation of non-scientifically sound evidence in court which leads to wrongful convictions as well as unsubstantiated judgments in civil and other court proceedings. Of these, the most tragic are the situations in which people have been incarcerated for years or executed due to wrongful convictions.⁹⁰

Suffice it to say that, even though there are many wrongfully convicted who have not been exonerated and there has not been an adequate study of “near misses” where faulty forensics did not result in conviction, the sheer number of wrongfully convicted is alarming. The National Registry of Exonerations⁹¹ shows currently that there have been 2,145 exonerations in the United States since 1989 resulting in innocent human beings spending a total of 18,750 years in prison. False or misleading forensic evidence is attributed by the Registry to about one fourth of the cases even though others have placed the number much higher.⁹² This does not take into account false or misleading forensics in civil cases where millions of dollars either has been paid where it was not warranted or has not been paid where it was.⁹³

In criminal cases, there is also another significant consequence of bad forensics. When the wrong person has been prosecuted and convicted, the actual perpetrator remains at large. There are numerous documented cases in which the real perpetrator committed other rapes or murders which would

89. Hon. Donald E. Shelton, *Twenty-First Century Forensic Science Challenges for Trial Judges in Criminal Cases: Where the “Polybutadiene” Meets the “Bitumen,”* 18 WIDENER L. J. 309 (2009).

90. This is still being studied and there are suggestions to broaden the scope of the typical studies dealing with conviction, primarily in murder cases. See, Richard Leo, *The Criminology of Wrongful Conviction: A Decade Later*, 33 J. OF CONTEMPORARY CRIMINAL JUSTICE 82-106 (2017) (suggesting the broadening of empirical studies to other cases and to “near misses” where convictions were avoided.)

91. The National Registry of Exonerations is a project of the Newkirk Center for Science & Society at University of California Irvine, the University of Michigan Law School and Michigan State University College of Law. See, THE NATIONAL REGISTRY OF EXONERATIONS, <http://www.law.umich.edu/special/exoneration/Pages/about.aspx> (last visited Apr. 8, 2019).

92. Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 VA. L. REV. 1, 14-16 (2009) (approximate 60%).

93. See, e.g., Joseph M. Price, Ellen S. Rosenberg, *The war against junk science: the use of expert panels in complex medical-legal scientific litigation*, 19 BIOMATERIALS 1425 (1998); and for a more current event see, *Johnson & Johnson Talcum Powder Cases*, Los Angeles County Superior Court, Case No. BC628228, and the Order of Judge Maren Nelson granting Johnson & Johnson’s motion for judgment notwithstanding the verdict setting aside a jury awarded plaintiff \$417 million in a case alleging injury from exposure to talc; Tiffany Hsu, *Risk on All Sides as 4,800 Women Sue Over Johnson’s Baby Powder and Cancer*, NEW YORK TIMES, September 28, 2017.

not have occurred if forensic scientists and prosecutors had done their jobs correctly.⁹⁴ The loss of life and tragedy to other innocent people who were their victims is incalculable. As lawyers and judges, it should be true that, as a matter of ethics of the profession, we should not use unreliable evidence to come to a wrongful judgment; but it also has real consequences as a matter of life and death in criminal cases and millions of dollars in civil cases. That harms everyone.

III. FORENSIC EDUCATION IN THE J.D. CURRICULUM

A. *The Purpose of a Forensic Education in Law School*

The purpose is not to train law students and lawyers to be forensic experts. The purpose is to train them sufficiently in the basic processes of science so that they can understand and identify fundamental forensics issues. This would enable them to work with forensic scientists and experts in the preparation and presentation of their cases. College and university undergraduate and graduate faculties with the encouragement of FEPAC and COFSE will educate the experts. However, there is still little support for the education of the end-users, the lawyers and judges, in the law school curriculum.

The National Academy of Science Report made it clear:

In addition, lawyers and judges often have insufficient training and background in scientific methodology, and they often fail to fully comprehend the approaches employed by different forensic science disciplines and the reliability of forensic science evidence that is offered in trial. Such training is essential, because any checklist for the admissibility of scientific or technical testimony is imperfect. Conformance with items on a checklist can suggest that testimony is reliable, but it does not guarantee it. Better connections must be established and promoted between experts in the forensic science disciplines and law schools, legal scholars, and practitioners. The fruits of any advances in the forensic science disciplines should be transferred directly to legal scholars and practitioners (including civil litigators, prosecutors, and criminal defense counsel), federal, state, and local legislators, members of the judiciary, and law enforcement officials, so that appropriate adjustments can be made in criminal and civil laws and procedures, model jury instructions,

94. See, e.g., the Rolando Cruz case where the real killer committed numerous crimes including the killing of a woman and a seven-year-old girl while false forensics were being used to prosecute Cruz through three trials. THOMAS FRISBIE AND RANDY GARRETT, VICTIMS OF JUSTICE (2005).

law enforcement practices, litigation strategies, and judicial decisionmaking. Law schools should enhance this connection by offering courses in the forensic science disciplines, by offering credit for forensic science courses taken in other colleges, and by developing joint degree programs. And judges need to be better educated in forensic science methodologies and practices.⁹⁵

B. Scientific Theory

We can only touch on the high points of what needs to be taught about science to law students, but it should give some indication of the substance that needs to be conveyed in more detail to students in their ordinary evidence classes and in electives as a part of the J.D. curriculum. However, very little of this is currently covered and none in sufficient detail to prepare students to become lawyers who can litigate scientific issues.

First, students must be exposed to basic science. That is, what does a scientist do when investigating a subject, collecting data, analyzing it and forming opinions. How do they frame those opinions and write reports. This process is mandated by *Daubert*⁹⁶ and by the language in *Kumho Tire* that,

The objective of that [the *Daubert* gatekeeping] requirement is to ensure the reliability and relevancy of expert testimony. It is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.⁹⁷

Real scientists do not discuss science with their colleagues in terms of being an advocate for one side or another in a controversy. They try to devise experiments to test hypotheses. The data that is collected is subject to scrutiny to avoid bias or contamination. The experiments are designed with controls and in an effort to isolate the relevant variables. A hypothesis is arrived at that is falsifiable and is not beyond the limitations of the testing process. Once adequate testing has occurred, the question is whether the hypothesis is contradicted by the data or whether the data is consistent with the hypothesis.

95. NAT'L RESEARCH COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (2009).

96. *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993).

97. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 152 (1999).

Second, nothing is proven. Science deals with uncertainty.⁹⁸ Science is an effort to explain phenomena through testing and research.⁹⁹ Scientific efforts are subject to error at the theoretical level, the practical level and the personal level.¹⁰⁰ As to the latter, cognitive bias in its many forms can affect the results.¹⁰¹

Third, students should be exposed to how forensic investigations may differ from much of what happens in scientific laboratory work. In general terms, the world is messy and the source of evidence may not be as reliable as if it were obtained in careful field studies. Controls still should be collected and tested to the extent possible and any shortcomings such as possible contamination or degradation should be frankly taken into account.

Fourth, students should learn through exposure to representative forensic scientific areas how forensic investigation, data collection analysis, opinions, report writing and testimony works in reality. By looking at real applications, they can see how the ideals of laboratory science can be, and sometimes necessarily are, compromised in real cases. They can appreciate how an investigating forensic scientist, working with law enforcement to solve a crime, might compromise the objectivity needed to form ultimate opinions in court. They can learn about allegiance bias and other imperfections that can affect the results.

Fifth, students should learn how to work with forensic scientists whether their role is as the proponent or the opponent of the testimony. Presentation of the case to the expert, allowing access to the raw data, avoiding contamination that might cause bias and preparing the expert to offer opinions that are based on the science, the reliable data and her true experience and expertise. Finally making sure that the opinions are of the type that a true scientist would offer and are not tainted by advocacy, speculation or overreaching.

98. Dennis V. Lindley, *UNDERSTANDING UNCERTAINTY*, Wiley (Rev. Ed. 2014).

99. Nicholas Christakis, *Blueprint: THE EVOLUTIONARY ORIGINS OF A GOOD SOCIETY*, (Little Brown spark 2019) 24; (“The *Scientific Method* . . . refers to a way of studying the natural world; it is characterized by systematic observation careful measurement, and *sometimes*, actual experimentation, all of which is coupled with formulation, testing, and revision of hypotheses.”); a more comprehensive and nuanced view of the scientific method(s) can be found in James Ladyman, *UNDERSTANDING PHILOSOPHY OF SCIENCE*, (Routledge 2002).

100. Paul Roberts, *Forensic evidence offers only probabilities, not guarantees that justice will be served*, PHYS.ORG NEWS (April 2, 2015) https://phys.org/news/2015-04-forensic-evidence-probabilities-justice.html?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Phys.org_TrendMD_1.

101. Joseph J Lockhart, Saty Satya-Murti, *Diagnosing Crime and Diagnosing Disease: Bias Reduction Strategies in the Forensic and Clinical Sciences*, 62 JOURNAL OF FORENSIC SCIENCES 6 (January 2017); Reinoud D. Stoel, *et al. Minimizing contextual Bias in Forensic Casework*, in *FORENSIC SCIENCE AND THE ADMINISTRATION OF JUSTICE* (Kevin J. Strom, Matthew J. Hickman, eds., Sage Publishing 2015)) 67-86.

C. Legal Theory

The other part of forensic education is legal theory. But fundamental to legal theory is that nothing should be admissible (it should not be offered and, if offered, it should be opposed) if the evidence does not meet scientific standards. In this regard, students should be educated on the latest iterations of the highest standards for forensic science as promulgated by the leaders in forensics. For instance, at this time, students should be familiar with the NAS Report, the PCAST Report, the DOJ Guidelines, the surviving SWG guidelines, any new NIST OSAC guidelines and any other governmental pronouncements on forensics. In addition, they should be familiar with guidelines and standards promulgated by the AAFS, the Academy Standard Boards, and other non-industry NGO's, including international and foreign organizations. They should also be aware of how to find industry standards promulgated by professional or trade organizations.

Of course, students will have to master the basic framework of *Frye*,¹⁰² *Daubert*,¹⁰³ *Kumho Tire*,¹⁰⁴ and *Joiner*¹⁰⁵ along with the various cases that have and will come along to interpret them. Case law that is specific to particular issues in comparative analysis, psychological examinations, medical opinions, and other issues such as evidence preservation, chain of custody, contamination, dry-labbing, and manipulated evidence should be reviewed.

Students should be trained on the legal and procedural means by which to proffer and object to forensic evidence. This should include an understanding as to what kind of evidence can be offered at motions *in limine* and what objections can be made. This would include the limitations on actual opinions offered understanding that opinions may not include statements like, "it is a match," "the defendant was at the scene," "the evidence is identical to the collected sample" or "to a reasonable degree of scientific certainty."¹⁰⁶

Student will also have to study enough about statistics to be prepared for testimony that might be offered on frequency, random match probability, likelihood, Bayesian analysis or Bayesian networks. They will have to know enough to be able to engage in a conversation with their own expert and, with guidance and study in a particular case, to cross examine the opposing expert. Ultimately, they will have to know how to object to the form and substance of an opinion that is quantified either verbally or numerically if it unfairly impacts the jury's decision-making function.

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

103. *Daubert*, 509 U.S. 579 (1993).

104. *Kumho Tire Co.*, 526 U.S. 137 (1999).

105. *General Electric Co. v. Joiner*, 522 U.S. 136 (1997).

106. Martin Enserink, *Evidence on Trial*, 351 SCIENCE MAGAZINE 1128, 1129-1132 (Mar., 2016).

In other words, at a bare minimum, students should not be granted a J.D. without a fundamental review of both the science and the law related to forensics. Even if they do not go on to take electives and learn about forensics in more depth, they should be equipped to understand the basics of science and the law and be able to interact intelligently with forensic experts. They should be able to discern in general what is acceptable and what is not under current scientific standards. And they should have a working knowledge of how to present the matters to the court in a way that will allow the judge to exercise her gatekeeping duties.

IV. THE STRUCTURE OF A FORENSIC PROGRAM

A. Core Curriculum Requirement

Simply put, all law schools have to educate law students as a part of the core, mandatory curriculum on basics of forensic evidence. This can be accomplished by a separate course or by increasing the amount of time spent on forensic evidence in the current evidence course. In other words, it is a matter of fundamental competency that all lawyers become familiar with the basics of forensic investigation, analysis, reports and testimony. To do this, texts have to be available and time has to be dedicated to this basic education in the classroom.

Current textbooks take much of the space publishing long excerpts from *Frye*,¹⁰⁷ *Daubert*,¹⁰⁸ *Joiner*¹⁰⁹ and *Kumho Tire*.¹¹⁰ This is fundamental to an understanding of the current law but, of course, hiding the ball is probably overrated in general and in this case in particular. The archaic, but still used, *Frye* test is worthy of mention as are some of the extensions of *Frye* created by courts to acknowledge the additional rules of evidence that pertain to admissibility of expert testimony.¹¹¹ *Daubert*, of course, sets forth the five foundational criteria for admissibility under the federal Rules of Evidence and redirects jurisdictions using the Supreme Court's guidance to a more modern, empirical view of forensic evidence.¹¹² *Joiner* says that abuse of

107. *Frye*, 293 F. 1013 (D.C. Cir. 1923).

108. *Daubert*, 509 U.S. 579 (1993).

109. *General Electric Co.*, 522 U.S. 136 (1997).

110. *Kumho Tire Co.*, 526 U.S. 137 (1999).

111. In California, see, e.g., *People v. Kelly* 17 Cal.3d 24 (1976); *In Re Lockheed Litigation Cases*, 115 Cal.App.4th 558, 564 (2004); *Sargon Enterprises, Inc. v. University of Southern California*, 55 Cal.4th 747 (2012) where California, as a nominally "Frye" state eventually adopted the *Daubert* gatekeeper approach.

112. *Daubert*, 509 U.S. 579 (1993) pp. 592-595, (Requiring the court's inquiry, in summary, into (1) whether the theory or technique in question can be and has been tested (is falsifiable); (2) whether it has been subjected to peer review and publication; (3) whether its known or potential error rate has been

discretion is the standard of review¹¹³ and *Kumho Tire* says that a flexible approach based on *Daubert* principles will be applied to non-scientific expert testimony.¹¹⁴ That can be conveyed without an enormous expenditure of time and reading assignment “capital.”

Also, for the core curriculum, there should be education on the basics of science so that the students can ask the right questions. Time allocated in the mandatory course probably would not permit in depth analysis of particular forensic fields unless one or two are used as an example. But it should make concepts clear such as uncertainty, hypothesis and testing, error rates, blind and double-blind testing, black box analysis, and the scope and limits of proper scientific opinions.

Fundamental concepts should be taught regarding obtaining and providing information to a witness, proffering expert testimony and conducting an *in limine* hearing opposing the admissibility of a witness’ testimony or limiting it to what is scientifically sound. This conceptual information should be translated into practical exercises that could be offered as a part of the evidence class itself or as part of a mandatory clinical practice course. The more that can be presented, the better. The intention is to equip the students to recognize the general issues in forensics and to do research and ask the right questions when forensic subjects arise in practice.

B. *The Structure of Elective Classes*

Law schools should also offer structured advanced courses in forensics as electives. Elective courses pose special administrative challenges. They have to be staffed by competent instructors and given at strategic times in the overall J.D. program for each graduating class. Popularity also has an effect on the economic decision to offer the course. However, even with these challenges in mind, a modest proposal would be to make courses available so that all students who wish to take electives in forensics can schedule them during the last two years of their J.D. program.

The first course should be an overview of forensics that takes off from the introductory material offered in evidence class and covers the broader territory of forensic science. A good example of this is the Moenssens, DesPortes and Edwards book.¹¹⁵ It is in need of some updating in part due

tested; (4) whether there are of standards maintained controlling its operation; and (5) whether it has attracted widespread acceptance within a relevant scientific community.)

113. *General Electric Co.*, 522 U.S. 136 (1997).

114. *Kumho Tire Co.*, 526 U.S. 137 (1999).

115. ANDRE MOENSSENS, BETTY LAYNE DESPORTES AND CARL EDWARDS, *SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES* (6th ed. 2013). Betty DesPortes, M.S., J.D., is a criminal defense lawyer and currently is the president of AAFS. The present author has also used this book to teach a ten-week forensic science class at the Santa Barbara College of Law.

to advancements in the last five years and also, perhaps, to cull some of the dated material including photographs and diagrams that have served their purpose in years gone by. Nevertheless, the approach of the book is illustrative of how a class can be taught. In outline form, it would start with a more detailed review of forensic science in general and the law on the forensics, including the latest material described above relating to NIST and the OSACs, reports like that of PCAST and new developments from AAFS and the consensus bodies. There could also be an effort to describe the developments internationally. The class would then go on to take particular areas of forensic science, such as fingerprints, DNA, trace, ballistics, etc., and look at them in more detail.

This overview course, if not offered every year, should be offered at least every two years so that every J.D. candidate would have a chance to take it. The idea, again, is not to train law students as forensic experts. The undergraduate and graduate schools are there to do that. If students want to pursue a joint degree in law and forensics, they should be given an opportunity to pursue the J.D. and a Masters or PhD. over an extended period of time, perhaps four years for a JD/MS or seven for a JD/PhD. However, if they want to be prepared as lawyers, the basic elective courses should be available to all students in the time it takes to get the J.D..

Additional specific electives should be offered on roughly a two-year rotation. These electives could be team taught by a forensic scientist and a law professor or by a law professor alone. Students should have an opportunity for a more in-depth excursion into a particular area. These electives could include classes on individual forensic subjects like, psychology, cognitive neuroscience, statistics, engineering, bio-ethics, DNA, trace evidence, chemical composition, glass analysis, accident reconstruction, bio-mechanics, drug and alcohol intoxication, accounting, document examination, firearms and toolmarks, fire scene, fingerprints, pathology, toxicology, anthropology, digital analysis or just about any subject in forensics. The availability of any course would be dependent on the availability of faculty and space in the schedule but an effort should be made to offer at least a couple electives each year.

It might also be possible for a law school to make courses available in other parts of the university or in allied institutions. For instance, law and psychology could be team taught by a professor from the medical school or graduate school in clinical psychology.¹¹⁶ The medical or graduate students could take the course as well and both faculties could confer credit. It would

116. If the present author may be permitted an autobiographical comment, over forty five years ago, while a student at UCLA School of Law, the author had an opportunity to take a class jointly taught by Law Professor George Fletcher and Psychiatry Professor Dr. John Suarez at the Neuropsychiatric Institute at UCLA Medical Center. It was a profound experience and was part of the foundation for the lifelong study of law and psychology and for the study of forensic science in general.

also be possible for students to seek out classes outside the law school and propose them for J.D. credit.¹¹⁷ Finally, courses could be available to audit for local members of the bar, possibly for Continuing Education Credits, in the event attorneys already in practice wish to catch up.

C. Concentration Leading to a Certificate

Although there may be a law school that has a full certificate program in place for law and forensics, the present author has not been able to find it. However, it seems like a natural development and one that is long overdue. Many schools have concentrations that lead to a certificate that can be earned along with the J.D.. For instance, U.C.L.A. offers certificates in the following concentrations: Business Law and Policy, International and Comparative Law, Critical Race Studies, Law and Philosophy, Public Interest Law and Policy, and Media, Entertainment and Technology Law and Policy.¹¹⁸ Harvard offers Law and Government, Law and Business, International and Comparative Law, Law, Science, and Technology, Law and Social Change, Criminal Justice, and Law and History.¹¹⁹ In both cases, and in the cases of many other law schools, there is a concentration in some aspect of science and technology but the emphasis is not on forensics as much as intellectual property and application of law to commercial developments in science.

The recommendation is simple: Follow the same general criteria that are established for other concentration programs and, upon the successful completion of such a program, award a certificate along with the J.D. at the time of graduation. Just like the other programs, say Business Law and Policy, it gives the student some incentive and a legitimate reference upon going into the work place. Employers, whether prosecutors' or public defenders' offices or firms that engage in civil or criminal litigation, would look favorably upon an applicant who took the initiative to obtain a certificate in forensics.

Tailoring a certificate to forensics, schools might consider something like the following requirements:

1. Completion of the overview of forensics class;
2. Completion of two or three additional forensics electives;

117. Most major law schools permit students to take joint classes or to petition to have law school credit for relevant law related graduate school classes.

118. See, UCLA LAW: DEGREE & SPECIALIZATIONS FOR THE JURIS DOCTOR, <https://law.ucla.edu/academics/degrees-and-specializations/> (last visited Apr. 8, 2019). While "Law, Science and Technology" sounded promising, on further inspection, the curriculum dealt more with intellectual property and law and science transactional matters rather than forensics.

119. See, HARVARD LAW SCHOOL: PROGRAMS OF STUDY, <http://hls.harvard.edu/dept/academics/programs-of-study/> (last visited Apr. 8, 2019).

3. Or, as a substitute for one or more electives, completion of an approved graduate level course in forensics; and
4. Completion of a paper on a forensics topic.

Upon successful completion of these requirements and the requirements for a J.D., the candidate would receive her J.D. degree with a Certificate in Forensic Science.

Having made the suggestion for a Certificate program, it should be noted that it would be a fairly easy program to add once a commitment is made to offering a serious forensic education to the JD curriculum. However, it is not necessary for a law faculty to commit to a certificate program in order to make forensics a part of a law school JD. Certainly, taking it one step at a time is better than not pursuing it at all. Therefore, redesigning the evidence course is a top priority; offering a forensics overview class and some forensic electives is not far behind. The certificate program would be a natural to follow. Additional encouragement could be offered by AAFS and FEPAC or COFSE if they were to develop accreditation for a properly run forensic certificate program.¹²⁰

CONCLUSION

It cannot be disputed that forensic science has a prominent place in the law as it is practiced today. There is every reason to expect that it will become even more prominent in the future. In addition, the sophistication of forensic science and the complexity of forensic investigations, analysis opinions, reports and testimony has increased exponentially. This is in part due to the advances in science but also due to the efforts of those in the highest places in the forensics community recommitting themselves to taking a scientific approach to forensics.

Meanwhile, substandard forensics makes its way into the courtrooms. The sad fact is that “experts” will always come forth to testify particularly if it is monetarily rewarding. The only gate between substandard forensics and the jury is held by the judge with the advice and counsel of the lawyers in any given case. The lawyers and the judges are the end-users of forensics and it is they who control what is displayed to jurors who have the critical job that often involves money, sometimes large sums, or the liberty or even life of those who come before them.

120. AAFS through FEPAC has a rigorous accreditation program for bachelors of science and masters of science programs in forensics and have accredited many major universities and colleges. FORENSIC SCIENCE AND EDUCATION PROGRAMS ACCREDITATION COMMISSION, <http://fepac-edu.org/accredited-universities> (last visited Apr. 8, 2019). Law schools will have to take the lead and create the programs but, upon the establishment of a number of “Certificate in Law and Forensics” programs, AAFS and FEPAC could be approached to establish criteria for accreditation.

Judges and lawyers have known this on one level or another for some time. *Daubert* was 25 years ago and should have sounded a wake-up call. Whether it did or not, substandard science is still being admitted into evidence. Judges have had time to become educated and so have lawyers who could, in turn, pass that on to the judges in the adversary system. But it still is not working. The hope is that legal educators and administrators who design and implement legal education will be willing to step up and make forensic education an integral part of the J.D. curriculum. From that beginning, the legal profession has an opportunity to help judges be the gatekeepers the United States Supreme Court and the rules of evidence in every state, requires them to be.