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Forensics and legal systems are often seen working together, but the relationship between the two disciplines is thornier and more complex than it may appear on the surface. This paper will examine why courtrooms struggle to accommodate forensic fields, how the nature of science can impede its utilization in court, and where legal education may fall short in educating students about the forensic sciences. After the literature is reviewed, solutions will be proposed to address each area of concern. Where possible, these solutions expand on existing infrastructure and ideas to make them easier to incorporate. Since the greater-scope issue is likely to continue, suggestions for future research are also provided to further explore how forensic science and the courtroom can be more compatible.

Keywords

forensic science, courtroom, medicolegal, law school

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Forensics and legal systems are often seen working together, but the relationship between the two disciplines is thornier and more complex than it may appear on the surface. This paper will examine why courtrooms struggle to accommodate forensic fields, how the nature of science can impede its utilization in court, and where legal education may fall short in educating students about the forensic sciences. After the literature is reviewed, solutions will be proposed to address each area of concern. Where possible, these solutions expand on existing infrastructure and ideas to make them easier to incorporate. Since the greater-scope issue is likely to continue, suggestions for future research are also provided to further explore how forensic science and the courtroom can be more compatible.

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Examining the Relationship Between Legal Systems and Forensic Science: Current Issues and Proposed Solutions

Since the formation of forensic science as a true field of study, integrating its many subdisciplines into the medicolegal process has been an ongoing effort. Though the current iteration of how this partnership operates, shaped by numerous Supreme Court decisions, is functional and eliminates many of the previous concerns that necessitated cases like *Frye* or *Daubert*, it is far from an ideal model. The way a court behaves is not conducive towards the presentation of forensic evidence; similarly, the way a court thinks is opposite that of forensics: while science moves at a rapid pace bolstered by research, picking up and putting down new theories or ideas as the years progress, the court prefers to stay put so that its laws and precedents do not require constant updating. The legal system is also far from well-educated in forensic science. While some attorneys may have taken a forensic science elective in school, the average jury member may be hearing about 'latent prints,' 'Y-STR screening,' or 'mechanisms of death' for the first time. It is clear that issues will abound as a result. This paper will examine these three major areas where forensic science and the courtroom, or legal system at large, clash. First, there is the very nature of the court system in many places around the globe, which tends to be adversarial as opposed to interventionist, and therefore detrimental to how forensic evidence is typically handled. Second, it is broadly understood that science moves more quickly and in different directions than the law, but finding a way to harmoniously marry the two remains a difficulty. Third and finally, the legal system tends to be woefully undereducated when it comes to comprehending science; this is markedly apparent when looking at how juries evaluate forensic expert testimonies, so the question becomes whether or not resources should be poured into educating the legal system, and if so, which resources and how much thereof. This paper

will not seek to enumerate the issues currently faced by the forensic science discipline alone, nor the courtroom alone, but rather look at the three aforementioned intersections of both systems. After the literature is reviewed, solutions will be proposed to address each area of concern. Considerations for the future will also be suggested to improve further research. Finally, although forensic science and legal systems exist around the world, this paper will primarily examine how the discussed issues play out in the United States of America.

Literature Review

Adversarial vs. Inquisitorial Systems

Legal systems are considered to come in two flavors: adversarial and inquisitorial. The latter system centers on "investigation and control of fact-finding by a neutral decision maker," whereas the adversarial system places the burden of fact-finding and presenting evidence on the parties in court, which are, of course, the antipodean defense and prosecution (Gertner & Sanders, 2018, p. 137; see also Chase, 2002). Hamer and Edmond (2019) describe the adversarial system as a contest, where each side is vying to control the dispute and its outcome. The judge, representing the court itself, is largely passive, stepping in to enforce the rules if the contestants come to blows but mostly seeking to remain impartial. Chase (2002) delineates three features that make up the adversarial process: party-controlled pre-trial investigations, the passivity of the judge, and how experts and their opinions are both acquired and used. It is the last feature that is of the most interest when it comes to examining how forensic science is used in court. Expert testimony becomes a malleable resource for either party; these witnesses are 'for' a party (as opposed to, say, 'for' objective presentation of information), they are paid and prepared by that party, and if both parties call witnesses, then these experts vie to control the reality of the case (Chase, 2002; Gertner & Sanders, 2018). It becomes apparent that even if

witnesses purport to "stick to the facts," in the eyes of the jury, they are partisan by the nature of how an adversarial system structures its usage of expert testimony. Hamer and Edmond (2019) raise the additional concern that many forensic scientists tend to work in labs or institutes affiliated with law enforcement. If called to the stand 'for' the law enforcement's party, then clearly there may exist a conflict of interest, but the adversarial system provides little in the way of a workaround, excepting Federal Rule of Evidence 706, which allows for a court-appointed neutral expert to testify and that Chase (2002) points out is rarely invoked. It is important to qualify all of this with the statement that adversarial systems do not lack accuracy. If this were the situation, then surely the American legal system (among others) would be in terrible condition. Adversarial systems are set up in such a way that works for certain types of cases, but forensic evidence suffers in these environments. Justice and accuracy can still be obtained, but the partisan cherry-picking of expert realities distorts the nature of science.

As with all sciences, forensic science seeks to remain objective, especially in a courtroom. However, the way in which forensic evidence is used, as previously noted, is not strictly neutral or objective. It is known that in the majority of criminal court cases, the prosecution has greater access to resources, particularly if it has the backing of government, which therefore means greater access to experts; the defense, in contrast, may struggle to supply the same level of resources (Gertner & Sanders, 2018; Hamer & Edmond, 2019). What does this mean? If the prosecution presents its expert(s) and the defense produces none, perhaps due to a lack of funding sufficient to hire and sustain any expert(s) equal to the caliber of the prosecution's, then the prosecution's forensic experts control the reality of the case's evidence. As Gertner and Sanders (2018) assert, "[g]overnment expert witnesses…become bargaining chips, their deficiencies unexamined" (p. 140). There is a compromise between vetting experts and their

evidence for the scientific truth and achieving victory in the courtroom. Additionally, it is important to also consider the jury, which may place more weight on the perception of credibility or reliability than the science that is presented. That is, when the science is confusing or complicated, a jury member may take cues from how the expert dresses, talks, and so on, to come to a decision (see Gertner & Sanders, 2018; Hamer & Edmond, 2019). The National Academy of Sciences report from 2009 sums up these lines of thinking succinctly: "The adversarial process relating to the admission and exclusion of scientific evidence is not suited to the task of finding 'scientific truth.'" Science can be used to carefully dissect an issue or problem and determine the truth of it; in an adversarial courtroom, it is used as a blunt instrument to shape reality according to partisan constructions of the truth.

Time's Arrow

As previously mentioned, forensic science and the legal systems with which it must interact are often at odds. Beyond fitting the square peg of forensic evidence into the triangular hole of an adversarial system, it is important to zoom out and consider the broader conflict: science, any science, versus law, temporally speaking. Cole (2017) states that for the law, "time is limited," and for science, "time is unlimited." Though cases must be decided and closed on deadlines, science seeks to revise, update, improve, etc. without being bound to dates on a calendar. This is particularly true for forensic science. Since the NAS report was released over a decade ago, the forensic discipline has been busily attempting to assemble itself into a better mold of scientific propriety, jettisoning those fields which have been proven unfounded when scrutinized (ex., bite mark analysis or hair morphology analysis), and 'scrubbing up' the more concrete ones (ex., nuclear DNA analysis or fingerprint analysis). However, this has left legal systems with a non-

insignificant dilemma: what to do with cases that were originally closed on the basis of now-disavowed forensic evidence?

For decades, evidence in the United States has been evaluated based on a few well-known Supreme Court decisions, each supplanting or clarifying the one before (*Frye v. United States* [1923], *Daubert v. Merrell Dow Pharmaceuticals, Inc.* [1993], *Kumho Tire Co. v. Carmichael* [1999]). *Frye* established the idea of general acceptance for evidence to be admissible in court; *Daubert* has largely replaced *Frye* in most states due to its expanded definition of how a method becomes valid for admission: 1) can it be, and has it been, tested?; 2) has the method undergone peer review and publication?; 3) have error rates (known or potential) been established?; 4) have standards been put in place to control how the method works?; 5) finally, has the method received widespread acceptance? (509 U.S. 579, 1993). *Kumho Tire* expanded the *Daubert* criteria to encompass non-scientific expert testimonies; this does not apply to the scope of the present paper but is worth noting. The *Daubert* standards operate with a good degree of efficiency. The issue that arises, however, is twofold: some novel scientific knowledge, no matter how promising, must be delayed in its admissibility until it meets all five criteria; and, on the opposite end, some scientific knowledge, now discredited, is still considered the basis for a conviction (or exoneration) that could potentially now be inaccurate based on the progression of the field (Cole, 2017).

It is prudent to illustrate the issue here with case examples. Cole (2017) discusses two such cases and how they provoked Californian and Texan ‘changed-science statutes.’ One of those cases was the conviction of William Richards in 1997 for the murder of his wife, Pamela. At the fourth trial, a forensic dentist named Norman Sperber testified that a lesion on Pamela’s hand at the time of her death was not only a human bite mark but also similar to William’s dental

patterns. Sperber provided a poorly defined estimation of the frequency, asserting that William's dental patterns appeared in "one or two or less" people per hundred (p. 446). Another dentist, Gregory Golden, testifying for William's defense, argued that Sperber's evidence was not valid due to a distortion of the photograph based on the angle it was taken at. Ten years later, William filed a habeas corpus petition. In this petition, two other forensic dentists argued that, based on a new technique in the forensic dentistry field, they could digitally remove angular distortion from photographs, and in William's case, they articulated new opinions: one said it did not match his dentition but could not rule him out as a source; the other agreed it did not match and doubted it was even a human bite mark. Sperber and Golden viewed the digitally altered images themselves; Sperber expressed doubt in his previous testimony and recanted it, and Golden suggested the mark could be a dog bite. While the petition was dismissed in 2012 by the California Supreme Court, William later had his conviction overturned with the passage of Chapter 623 of Section 1473 of the California Penal Code in 2014. Chapter 623 states that false evidence, defined as "opinions of experts that have either been repudiated by the expert who originally provided the opinion at a hearing or trial or that have been undermined by later scientific research or technological advances," can provide relief to habeas corpus petitions (Cal. Penal Code § 1473). In William's case, not only was there a technological advancement (digital alterations), but the expert in the original conviction (Sperber) repudiated his own testimony. Furthermore, since 1997, bitemark analysis has dramatically fallen from favor in the forensic disciplines (see NAS, 2009; Presidential Council of Advisors on Science and Technology [PCAST], 2016). Even if Sperber had not recanted, William would have had grounds to argue that bitemark analysis was now "undermined by later scientific research" based on the rapid pace at which forensic science has backpedaled from bite mark analysis.

Knowledge of Forensics in the Courtroom

The final issue at the intersection of forensic science and legal systems is, to simplify slightly, who is in the room when testimonies are being presented. Koehler and Meixner (2016) frame this as input-output: forensic samples are input into the processes that generate conclusions and data, and these data are then output to a third party, usually the judge or jury. Judges and jurors cannot be expected to have a background whereby they intuitively understand the nuances of forensic evidence and weigh it accordingly (Eldridge, 2019; Koehler & Meixner, 2016; NAS, 2009). However, prosecutors or defense attorneys are also unlikely to have a strong knowledge base of forensic science; they are not exempt from ignorance either (Evans et al., 2019). All of this comes together to potentially undermine the value of forensic evidence in court. As discussed above, if a juror does not know what to make of an expert's testimony, they may turn to cues that indicate trustworthiness, excising the science entirely in their decision-making process (see Eldridge, 2019; Gertner & Sanders, 2018; Hamer & Edmond, 2019). Additionally, this issue circles back to the way the adversarial system is set up. Cross-examination is incredibly important for rooting out "scientifically indefensible statements" (Evans et al., 2019, p. 21). Through cross-examination backed by a solid grasp of forensic evidence, nearly any testimony can be determined to be scientifically defensible (or not). Unfortunately, if cross-examination falls solely on an ill-equipped defense, then the prosecutor's 'star witness' may escape scrutiny and succeed in convincing the jury. This issue is the most straightforward of the three in terms of its solutions being the most readily addressable, which will be covered in the next section.

Solutions and Discussion Navigating the Adversarial System

It is highly unlikely that the American court system will move away from a firmly adversarial process. Therefore, no suggestions will be made that propose radical reform. Moderate, less radical improvements can certainly be made both on the part of the forensic expert and the court.

Gertner and Sanders (2018) suggest adopting provisions within expert codes of conduct that stipulate an expert's duty is to the court above any partisan affiliation. The authors point to the Civil Procedure Rules of New South Wales, Australia, which include such a stipulation. This suggestion follows the general trend that emerged after the publication of the NAS report, which is placing more defined standards on the forensic scientists themselves. This includes increased training, more academic programs centered on forensic science, better accreditation, and so forth (see NAS, 2009; PCAST, 2016). One idea that must be emphasized through forensic education is that forensic science and by extension, the forensic scientist, is and must remain impartial. Even on the partisan battlefield that is an American criminal courtroom, the forensic scientist has a duty to deliver the scientific truth of the matter.

In terms of improvements for courts, the majority of recommendations boil down to the court taking a more active stance during a case. The NAS report (2009) points out that courts, or rather judges, have repeatedly failed to 'check' the experts called by either side for the "validity of their approach or the accuracy of their conclusions" (p. 53). As Gertner and Sanders (2018) point out, even when scientific weaknesses exist in a testimony, judges are reluctant to enforce admission rules. Though Hamer and Edmond (2019) speak from an Australian perspective, their calls to make judges a more active participant in a case are applicable to American courts. This directly feeds into the proposed recommendations for better educating the legal system: with a more informed judge, questions of admissibility may be answered more readily.

Addressing Changes in Scientific Disciplines

The solutions listed here do not explicitly deal with overturning convictions (although that is a highly beneficial result of improved DNA analysis). Instead, based on Cole (2017) and Beety (2020), here it is suggested that changed science writs or statutes are enacted more broadly. Since 2017, four more states have enacted laws to enable cases to be reopened due to discredited forensic evidence: Connecticut, Wyoming, and Michigan in 2018 and Nevada in 2019 (see Beety, 2020). Changed science writs can raise the bar for the admission of evidence and also allow for relief or exoneration post-conviction. The current changed science writs present different forms, but they generally ease the requirements for filing habeas petitions based on new evidence, evidence that undermines what was previously testified, or evidence that has had its means of analysis and evaluation shifted since originally examined (Beety, 2020).

In the *Daubert* decision, it is written that "there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory" (p. 596-7). While changed science writs enable amendment after the fact, it is not yet clear how novel forensic techniques might be evaluated for admissibility. Cole (2017) argues that courts need to fully acknowledge the changes occurring in forensic science to properly weigh the admission of forensic evidence, and that to do so they need an "understanding of the provisional nature of scientific knowledge" (p. 451). Once more, it seems that this issue loops back around to the question of how educated in science the legal system is.

Educating the Law

The last of the issues covered in the present paper and the most relevant to all of them, the education, or lack thereof, on how forensic science operates within the legal system, is extremely important to address. Evans et al. (2019) offer a comprehensive overview of strategies to better

educate legal practitioners. While current efforts do exist within school systems and professional associations, more can certainly be done. Of the recommendations proposed by Evans et al. (2019), this paper echoes three most strongly: 1) changes to law school curricula and requirements; 2) creation of a certificate in forensic science for law school students; 3) requirements to take continuing legal education (CLE) training in forensic science or science. Notably, these all pertain to education, not professional associations. This paper contends that incorporating science education into existing frameworks is the best first step, which will then be supplemented by other proposals, such as FEPAC or AAFS support.

In the first instance, law school students should have regular and non-superficial exposure to forensic science fundamentals if they are at all interested in criminal law or related fields. This includes the basics of how science operates (ex., the scientific method), common forensic science terminology, and science's use of data. Further to this, criminal mock cases or mock trials should involve forensic evidence. This is an excellent opportunity for law school students to not only practice their direct and cross examination skills, but, ideally, work with forensic science students, who in turn can sharpen their skills with analyzing evidence, writing reports, and testifying. This can take the shape of two or three courses integrated into existing curricula as mandatory electives.

The second instance builds on the first and offers a more concentrated approach. Keeping with the idea of forensic science courses being available to law school students, this certificate would offer coverage of the fundamentals as well as electives that dive deeper into certain forensic disciplines. It is conceivable that such a certificate could be made mandatory for those who intend to go into criminal law in any form.

Finally, since CLE is already mandated for legal professionals, it would be feasible to also require legal practitioners to take CLE credits in either forensic science or, more broadly, scientific fundamentals. Additionally, this continuing education should address how to recognize potentially biased or faulty evidence before it is admitted or included in a testimony. In general, having both attorneys and judges aware of even just the basics of scientific philosophy is much better than the ignorance that currently predominates. Evans et al. (2019) offers many theoretical solutions; this paper has pulled out the three that appear most viable at this current juncture.

Conclusion

Forensic science and the courtroom interface in both positive and negative ways. This paper has examined the big picture issues of how an adversarial system undermines forensic evidence, how changes to the scientific knowledge base must be addressed, and how a lack of scientific education for legal practitioners hampers the mission of the justice system to find the 'truth.' Much has been written on the need for improvements to forensic science since the oft-cited NAS report lit a fire under the discipline in 2009, and the courts are no stranger to criticism either. However, progress is being made. The solutions proposed here offer continuations and expansions on current systems with the express goal of bettering the way forensic science is presented, handled, and interpreted in criminal courts.

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