Time to think differently: catalysing a paradigm shift in forensic science

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‘It is not the strongest of the species that survive, nor the most intelligent but the one most responsive to change’.

Attributed to C. Darwin, FRS.

It has been a privilege to be part of the adventure that culminated in the Royal Society’s twin events designed to enable and encourage the forensic science community to come together to discuss and plan a vision for the future, not only for the UK, but as partners in a global ecosystem. It is also an honour to present a collection of some of the presentations within the pages of the Philosophical Transactions of the Royal Society in its 350th year, an anniversary that it shares coincidently with the octocentennial celebration of the Magna Carta—the earliest moral and ethical script for the basis of our modern judicial system.

In 1297, the Magna Carta was finally incorporated into English statute law and while today it is perhaps viewed as a document of almost mythical influence, it retains the ability to transcend barriers of language and divisions of culture and ideology. It is based on the principles of freedom, democracy, justice and Rule of Law and philosophers allege that when these are denied, we should prepare to embrace the inevitability of injustice. The strength of the ethos embedded within the Magna Carta still resonates today in many laws associated with human rights including the US Bill of Rights (1791), the Universal Declaration of Human Rights (1948) and the European Convention on Human Rights (1950). Only the spirit of clauses 39 and 40 of the original document remain identifiable within English law:

Clause 39. No free man shall be seized or imprisoned, or stripped of his rights or possessions, or outlawed or exiled, or deprived of his standing in any way, nor will we proceed with force against him, or send others to do so, except by the lawful judgment of his equals or by the law of the land.

Clause 40. To no one will we sell, to no one deny or delay right or justice.

In the fourteenth century, these were broadly interpreted as a universal right to justice and a fair trial by our peers (a trial by jury).

As forensic scientists, we may overlook the subtlety of this document’s enduring spirit of influence, and it is likely that few give a second thought to its impact on our daily professional occupations. But we are certainly not immune to the resonance of its innate call of duty, and nowhere does this become more apparent than when there is systemic failure and we seek to identify the weakness that precipitated the breakdown. Science has often been accused by the law of adopting a laissez-faire approach to its responsibility to the courts, but equally the courts have been accused of abrogating responsibility by failing to understand or convey the nuances and limitations of the scientific evidence they present to support their case. There is no doubt that forensic science is of high significant value to the courts, but of late it has come under increasing criticism across a number of evidence types. If science is to continue to be of value to the court and to play its part in a ‘fair’ trial then we, as forensic scientists, must accept the onerous responsibility, in genuine partnership with our legal colleagues, to ensure that weaknesses are identified and addressed and that both our science and our scientists are fit for the purposes against which they will be measured and held to account in the court. Equally, our judiciary, jurists, policy-makers and politicians must accept and understand that science is rarely absolute and that the expert witnesses will articulate to the best of their ability the limitations within which their scientific
interpretations may be considered, and this requires to be
carried both realistically and honestly to the jury.

The responsibilities placed on the shoulders of today’s
forensic scientists can be unrealistic, with punishing demands
to be consistently and unerringly accurate, precise, informed,
impartial, definitive and right. In a perfect world, these would
of course be achievable every single time, but science and its
interpretation by scientists does not fall easily into a strictly
defined binary categorization of right and wrong, or black
and white. Further, it is this interpretation of evidence for a
fundamentally lay audience that perhaps best conveys the
subtle but critical difference between the conventional sci-
entist and the forensic scientist. The former is free to express
their limitations and reservations within a sympathetic and
understanding environment of like-minded individuals,
whereas the latter must be able to both interpret and
convey the same information not only within that learned
society but also to an almost exclusively lay audience with
different expectations and exacting demands. Effective and
efficient communication and understanding of science are
viewed as significant constraints in the courtroom and the
source of much angst and conflict. Avoidance of adverse dis-
course by achieving common agreement can only benefit
the judicial process as lawyers seek to assist the undisputed triers
of fact (the jury) to reach a sound and honest decision of guilt
or innocence.

Indeed, it has been argued that forensic science is perhaps
one of the most impactful examples of public and societal
engagement with science, and, therefore, it is incumbent
upon the scientists to be vigilant in self-governance and
appraisal to ensure that the jury and the legal teams have a
full and realistic understanding of the current state of play
for the science that they seek to use and understand. Neither
the science nor the scientists are infallible and indeed both
must expect to come under intense scrutiny in an adversarial
legal system, but there is also a duty of responsibility on all
participants within the courtroom to have a clear and
honest understanding of where the safe and undisputed boundaries
are in relation to fact and strength of opinion. If
either the science or the scientist is found to stray beyond
those accepted limits, then it is imperative that we recognize
that the costs may be high and the ramifications far reaching.
They may not simply affect the future standing and career of
the expert witness or the credibility of a laboratory or a police
force but have the potential to undermine societal confidence.
In this, the unwitting victims may be liberty and justice—the
cornerstones of society.

Ironically, while we may all be guilty of focusing too fre-
cently on our limitations and restrictions, the greatest
benefit and value of forensic science lies in its holistic appli-
cation to the matter at hand, by providing a contextualized
input into both the investigative and evaluative processes.
If forensic science is to contribute both effectively and infor-
matively to the judicial process then it must be accepted as
more than an isolated scientific test, delivering a prescrip-
tive result by a lone bench scientist. Confining forensic
science to silos produces both one-dimensional data and
one-dimensional thinking, both of which have reduced
inherent value and lead to a less robust environment. By
addressing aspects of the inter-relationship between science
and the court as well as that between science and the inves-
tigators, we can begin to create a holistic vision of the
future which encourages forensic science to develop as a
robust and scientifically accepted resource for effective use
across the entire modern criminal justice system.

A catalyst moment occurred in 2009 when the US National
Academy of Sciences (NAS) report informed that the forensic
science community failed to deliver on the standards neces-
sary to meet its responsibilities. The report conveyed forcefully
and definitively, for the avoidance of all doubt, something
which many practitioners and academics had long known—that
without immediate intervention, forensic science was
heading for a crisis on an international scale.

Probably the most damning general statements from the
NAS report concluded that there was a:

...dearth of peer-reviewed, published studies establishing the
scientific basis and validity of many forensic methods. (p. 8)

and that—

Among existing forensic methods, only nuclear DNA analysis
has been rigorously shown to have the capacity to consistently,
and with a high degree of certainty, demonstrate a connection
between an evidentiary sample and a specific individual or
source. (p. 100)

The NAS report delivered a stark reality check for forensic
science, and one that shocked a normally compliant and
conservative community into accepting that there were sig-
nificant issues that required to be addressed and critical
jobs to be done if the forensic science house was to be brought
into order. That this task was largely laid at the door of the
scientist has not been so readily accepted and we have
tended to hide behind the laziest solution that first springs
to mind—we need more funds to be made available. But it
is well recognized that increasing the cash flow to a system
that is not fit for purpose and is fundamentally flawed will
not carry any confidence of securing a positive fix. Indeed,

This important community has a responsibility to address
the current crisis, be brave enough to embrace change, ident-
ify what works and what does not, protect no sacred temples of
tradition and work with vigour towards a solution that
will improve the core health of the ecosystem. When will
the community become sufficiently brave to stand up and
refuse to comply with a demand to undertake a task because
the science is not fit for purpose or the practitioner is not suf-
ficiently experienced? Where is the integrity of the scientist
who allows either themself or their science to be victimized
to perform or to generate revenue irrespective of detriment
to them, their discipline or the wider community? Accepting
as we do that our system is fundamentally flawed (there has
been no major disagreement with the views of the NAS
report), then if we choose to continue taking risks with our
scientific integrity, we must accept the consequences without
complaint, when the courtroom holds us to account.

Although the ripple effect of the NAS report was felt in
the UK, it is what occurred since that time that has truly
focused attention on the future health of forensic science in the
UK and its role in the wider global community—leading
to it no longer being fit for purpose. What can only be
described as seismic changes occurred in the UK forensic
science community and fragmentation escalated in England
and Wales in 2012 when the UK Government closed the For-
ensic Science Service (FSS) and their operational services
transferred into an almost exclusively commercial market, causing a market value collapse of 40% in just 24 months. The House of Commons Select Committee on Science and Technology launched an inquiry into the possible long-term effects of the FSS closure and produced two highly critical reports. In late 2014, a National Audit Office briefing was equally critical of the management of forensic science provision in England and Wales and expressed serious concern for its future health. These reports served to consolidate mounting fears that forensic science is failing and if we remain inactive, then we should prepare ourselves for miscarriages of justice and not just a national but a global crisis in confidence and capability.

In just the first three months of 2015, we have seen criticism of the scientific validity of low copy number DNA and the mathematical software used to de-convolute DNA mixtures in both the USA and Australia. The validity of conclusions drawn by the FBI on hair evidence has been heavily criticized and the scientific validity of ballistics has been challenged. However, in this ruling there also lurks an astonishing judicial compliance accepting that the status quo of poor, if not absent scientific underpinning for some areas of forensic evidence is acceptable. Forensic science is rightly being held to account and so are our scientists. Are we now experiencing the end of the beginning or the beginning of the end of that predicted crisis?

Whichever it is, we must stop paying lip service to the problems at the heart of our community, and simply demanding more funding will not make it all disappear like a bad dream. Only changes to culture and communication, in true partnership with our legal colleagues, will turn this situation around and it will require bold and uncompromising scientific redress of the highest caliber. There can be no tolerance for shoddy science and no space for the unqualified in the courtroom. It is time to stop doing ‘forensics’ and start doing real ‘science’ by real scientists that the courtroom can use with confidence.

It is almost inconceivable that the most sadly neglected relationship within the forensic science ecosystem is actually the one that is most fundamental to successful change—that between the scientists and their legal colleagues. This relationship is core to the effective functioning of any future partnership and has long been a source of friction for reasons that have little logical basis. This was the paradigm shift that the Royal Society events sought to address. That each side has a full and realistic understanding of the needs and limitations of the other can only benefit the future health of the forensic science ecosystem and this brings into focus two overarching aspects of the scientific and legal interface that we can begin to address with almost immediate effect.

1) As scientists, we must provide the justice system with confidence in the evidence that we present within a criminal case and this can only be achieved through completion of the appropriate baseline and applied research, which is currently inadequate for many subjects as identified by the NAS report and the research gap analysis tool trialed at the Royal Society Chicheley Hall event. Equally, the quality of our practitioners and their credibility as core scientists must be beyond reproach—the statement of ‘I have been doing this for 20 years’ or ‘I have seen hundreds of these’ must no longer be tolerated. For the courtroom to be presented with less than robust science via sometimes substandard practitioners is at best disrespectful and at worst jeopardizes the basic premise of a ‘fair trial’. We must be both bold and brave about exposing and recognizing baseless ‘junk’ science and cowboy practitioners.

2) We must be able to present our science in a manner that is not only accurate and robust but both understandable and coherent for all—including lawyers, judges and the general public. These players may last have encountered frontline science in their school years and may indeed have studiously avoided contact with it since that time—except perhaps what is read in fictional accounts and watched in the media. We cannot expect a lay audience to appreciate the nuances of our discipline nor expect them to have the confidence to be critical and challenging of our reasoning. We need to be clear and honest professional science teachers and communicators.

These two concepts are inherently reliant on a symbiotic relationship between science and its scientists and the law and its lawyers, and perhaps especially in an adversarial system we need to abide by standards that recognize what is agreed and uncontroversial fact and what is open for debate and interrogation within the context of the case. We must be in a healthy position to embrace the very best of the technological advancements (past and current) presented to us so that they can serve the ultimate purpose of fairness and judicial equality in the identification of truth and the implementation of justice. Such stringency does not reject or inhibit emerging science, rather it requires us to manage it responsibly and effectively to ensure that we do not transgress capability boundaries. All of our science, past, present and future, needs to meet agreed high standards of acceptance within both our own community and that occupied by our legal colleagues.

Within the pages of this issue of the Philosophical Transactions, we have tasked our authors with detailing some of the current challenges facing our forensic science community. Of fundamental issue is whether these have seen some redress and advance since the 2009 NAS report, and if not, what then do they think is the future for forensic science and its ability to provide a holistic approach that maximizes value to the triers of fact? It does not make comfortable reading at times, but we must be brave enough, honest enough and mature enough to face the reality of where we currently stand—as to ignore reality is, in our view, not a viable option.

There is no doubt that the forensic science ecosystem stands at a critical crossroads and there must be a common responsibility taken for the changes that need to be enforced. Of one thing we are absolutely certain, our current path is destined for disaster if we choose to carry on simply doing more of the same. If we are to have any hope of redressing this lamentable situation then we must also be distrustful of parochialism and intolerant of sub-standard science and rogue practitioners. If we have a will to change our culture and communicate more effectively with our legal partners, then perhaps we have a realistic chance of meeting the enduring values at the heart of the Magna Carta.

We believe that the green shoots of this paradigm shift are emerging and they began subtly when like-minded and equally concerned scientific colleagues from around the world congregated at the Royal Society for two days in February to talk openly and honestly in front of some of our most senior judiciary—many did not even know they were in the room as they watched, listened and absorbed our views of
our own world. This delicate, fledgling relationship grew and blossomed beyond our wildest expectations in the second Royal Society funded event, culminating in a unified will for disruption of the status quo and an appetite for action. Without the support of the Royal Society this would never have happened, and our community should recognize and applaud the trust that was placed in us all as we tentatively edged across the stormy and largely unchartered waters between science and law. Like the infamous Christmas football game in the trenches of World War 1, for a time we made peace, we gained mutual respect and claimed common ground. That precious space cannot now be allowed to disappear and it is imperative that we seize the moment and nurture and encourage those emerging synergies with our senior legal colleagues. The time has come to reject the inadequacies of the past and embrace a healthy new culture that can steer our ecosystem into calmer and more productive waters, a culture of confidence and professionalism which supports openness and trust, where research, technology, leadership and workforce development are all valued as a collegiate part of the holistic community. If this is the bright future that we wish to achieve and the legacy we wish to leave behind, then we must genuinely work together and not let the current woes of the discipline and the egos of an intransigent old guard smother the green shoots of a paradigm shift that broke new ground in the octocentennial year of the Magna Carta.

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Endnotes
1 Strengthening Forensic Science in the United States: A Path Forward, Committee on Identifying the Needs of the Forensic Sciences Community. 2009 National Research Council of the National Academies.
8 2015 IL App (1st) 121016 No. 1-12-1016, THIRD DIVISION Modified opinion filed April 22, 2015 [77–80] and [121–124].