Forensic Science at the University of Leicester
The University of Leicester has a long history of forensic science research and innovation, beginning with the discovery of DNA profiling by Professor Sir Alec Jeffreys in our Department of Genetics in 1984 and more recently we hosted the 4-year, EU-funded INTREPID Forensics interdisciplinary research programme (2014-2018). Our research is underpinned by interdisciplinary collaborations, which ensures that the criminal justice implications of forensic science innovation is at the forefront of our projects. We work closely with a range of national and international stakeholders to ensure that our research is timely, transformative, and impactful.

About the authors
Lisa Smith is a Professor of Criminology and Editor-in-Chief of Science and Justice (Elsevier). Her research focuses on the role of forensic science in the criminal justice process, including jury decision making about forensic evidence, human factors in forensic science, and the implementation of forensic science in low-resource environments (including conflict and post-conflict settings, displaced communities, and humanitarian contexts).
Mark Jobling is a Professor of Genetics who has researched and written in the area of forensic genetics (DNA) for over 20 years. Jon Wetton has 25 years’ experience in forensic genetics, including 13 years at the UK Forensic Science Service, and has been training students and has worked with Jobling at Leicester since 2013. Their areas of work include research to enable the application of Y-chromosome testing (Y-STRs) and new sequencing technologies in forensic casework in the UK, and the use of animal DNA analysis in casework. They are members of the Forensic Science Regulator’s Y-STR Working Group.

In the following sections, we address some of the questions raised by the inquiry call for evidence, focusing on specific areas which are relevant to our collective research and professional expertise.

1. Is forensic science contributing to the delivery of justice in the UK? What are the current strengths and weaknesses of forensic science in support of justice?

1.1 There is no doubt that forensic science has positive impacts on the delivery of justice in the UK. This has been achieved primarily in terms of generating intelligence and evidence to support investigations and prosecutions. The most powerful contribution made by forensic science is observed in cases where a suspect not otherwise known by the police is identified through the use of forensic and/or biometric databases. This is particularly evident in cases of violent crime committed by perpetrators who are strangers to the victim/s, however it is important to note that such cases account for a very small proportion of all reported crime in the UK. Investigations of cold cases and missing persons have also benefited from innovation in forensic science, which enables justice to be served long after an original investigation has been abandoned.
1.2 Forensic science also serves the important function of excluding suspects from investigations, which is an equally critical function in the delivery of justice. In addition, forensics can provide opportunities for post-conviction exonerations of innocent individuals, and some countries (e.g. USA) have demonstrated great success with coordinated efforts in this area¹. The Innocence Network UK (INUK)² was established in 2004 as a national support mechanism for education and casework focused on wrongful convictions. However following the closure of INUK in 2014, the UK’s approach to investigating potential miscarriages of justice is lacking and is in need of reform to ensure justice is accessible to all.

2. Understanding and use of forensic science in the criminal justice system

2.1 What is the scientific evidence base for the use of forensic techniques in the investigation and prosecution of crimes? Are there any gaps in that evidence base?

2.1.1 Over the past decade, there have been largescale national reports produced in the United States which have attempted to map the forensic science landscape and evaluate the scientific evidence base for various forensic techniques³. Many of the techniques reviewed in these reports are also routinely used in the UK, and therefore some of the recommendations are applicable in the domestic context. Across these reports, concerns were raised about the lack of scientific evidence underpinning some commonly used techniques, including (but not limited to) pattern recognition practices such as fingerprints, firearms, and toolmarks.

2.1.2 A number of publications, including the PCAST report (2016), have highlighted a need to shift from focusing on theories of ‘uniqueness’ (which cannot be scientifically validated in many cases) which underpin many forensic science techniques, to instead establishing robust data about the abilities of experts to detect differences between stimuli. This requires more research focused on human factors in forensic science, including better understanding of the cognitive process of pattern recognition, the psychological nature of ‘expertise’, and sources, causes, and consequences of cognitive bias – all of which would improve our understanding of the reliability and validity of forensic techniques, but would also enhance the recruitment, training, and proficiency testing of forensic experts.

¹ See the Innocence Project (www.innocenceproject.org) who have supported 362 post-conviction exonerations in the USA since 1992
² The Innocence Network UK (INUK) coordinated Innocence Projects around the country, mainly based at university Law Schools
2.2 **What is the level of understanding of forensic science within the Criminal Justice System amongst lawyers, judges and juries? How can it be improved?**

2.2.1 Levels of understanding of forensic science by lawyers is an important consideration, both for those working on behalf of the defendant/s as well as the prosecution. However, lawyers are not trained scientists, and so their ability to fully appreciate the contribution and limitations of scientific/technical evidence is limited. A lack of understanding can undermine the administration of justice through improper use of forensic science during prosecutions, inadequate defence strategies, and inappropriate questioning of expert witnesses during examination at trial.

Our experience of working with LLM programmes in higher education highlights that basic training in scientific evidence is lacking, and material designed specifically for students training in criminal law would be welcomed. This knowledge gap is also evident in our work with university-based miscarriage of justice pro bono programmes, where a lack of basic awareness of forensic science limits students’ abilities to review cases for new evidence.

2.2.2 Judges act as gatekeepers in court, and therefore play a crucial role in determining the admissibility of expert testimony (including forensic science). The irony of this role is that expert testimony must be able to “provide the court with information which is likely to be outside a judge’s or a jury’s knowledge and experience” — yet it is this very same judge that is required to decide on the reliability and validity (and therefore admissibility) of the expert testimony which is, by definition, beyond their expertise and experience.

Steps have been taken in the UK to produce judicial primers designed specifically for judges, the first of which focused on DNA and forensic gait analysis. Evaluative research is needed to establish whether these primers are being used by the judiciary, and whether they are in fact enhancing understanding of these forensic techniques.

2.2.3 Juries, as the triers of fact in trials, have attracted the majority of attention from researchers interested in decision making about forensic science. A large body of psychology research literature has explored the cognitive process of juror/jury decision making, and more recently a subset of this research has focused on scientific evidence and juror decision making. Throughout this literature it has been demonstrated that jurors have poor levels of understand of forensic science (possibly informed, in part, by fictional media representations) and they struggle to correctly incorporate scientific evidence into their verdict decisions.

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4 Crown Prosecution Service Expert Evidence Legal Guidance


Smith & Bull (2012) Identifying and measuring juror pre-trial bias for forensic evidence: Development and
Ensuring clear, and accurate, communication of scientific testimony in courtrooms is the first step to improving jury decision making. Some progress has been made in this regard, for example discouraging experts from testifying to ‘matches’ or ‘100% certainty’ when referring to forensic results. However, research has also demonstrated that jurors are not adequately equipped to correctly interpret probabilities and statistics associated with expressing uncertainty in expert testimony. Therefore more research is required about various types of communication (e.g. verbal scales, etc.) before evidence-based recommendations can be adopted by the courts.

3. Standards and regulation

3.1 Is the current market for forensic services in England and Wales sustainable? Are changes needed to ensure forensic science provision is maintained at the level required? What are the risks of a market approach, for example what happens if a provider goes out of business? And what is the impact on quality?
3.1.1 The recent crisis with Key Forensic Services (KFS), one of the three major forensic science providers (FSPs) in the UK, demonstrates very clearly that the current system for forensic services is not resilient, and not sustainable. KFS’s situation was not widely publicised, and they managed to come back from the brink. If they had not, it seems unlikely that the other two FSPs would have been able to pick up the slack effectively. This would have had negative impacts on ongoing casework, leading to long delays in the analysis and provision of evidence. We have no evidence to suggest that quality of widely practiced DNA-based methods would suffer, given that all FSPs are accredited for these.

3.2 Is the system of accreditation working successfully to ensure standardised results and the highest quality analysis and interpretation of significance of evidence?
3.2.1 For widely practised methods such as autosomal STR profiling, the accreditation process works well, because it ensures the work is done to a high standard, and the cost of accreditation is easily supported given the workload that FSPs undertake. The problem arises for less often used methods. Here, the cost of accreditation and its maintenance are high, yet the income from these methods is relatively low given that they are rarely deployed. An example is human mitochondrial DNA testing, which in some cases (e.g. where hair or old bone samples are all that are available) is very valuable. To our knowledge, this standard and internationally accepted method is not available currently from FSPs in England and Wales. Another example is

validation of the Forensic Evidence Evaluation Bias Scale, *Psychology, Crime and Law*, 18, 797-815
the use of DNA technology to analyse animal (e.g. pet) hair associated with crime scenes. Our view is that a commercial system is ill-suited to maintenance of accredited provision of techniques that are rarely used, and that some back-up system is required that would allow high-quality services in these areas to be deployed when these are needed.

3.3 What role should the Forensic Science Regulator have? If the Forensic Science Regulator is to have statutory powers, what should these be?

3.3.1 The FSR should have statutory powers to accredit and enforce standards, and to require operators that do not abide by standards to stop operating. We would also favour giving the FSR powers to ensure that a minimum set of forensic capabilities are maintained within England and Wales; this could, under the current system, involve the central funding of accreditation for rarely used methods that are nonetheless important to forensic service provision (see 3.2.1).

4. Forensic science research landscape

4.1 How should further research funding for forensic science be justified? What should be the focus of such research? What is the role of UK Research and Innovation, especially considering the interdisciplinary nature of much forensic science?

4.1.1 Forensic science is an inherently interdisciplinary research area (e.g. by definition it is the application of science to legal matters), yet most research which is published is not conducted by interdisciplinary teams. UKRI could play a key role in commissioning research which explicitly requires interdisciplinary approaches, which would serve to improve the overall research and its impact.

4.1.2 Fundamental scientific research is crucial in order to ensure continued progress in forensic innovation. This type of research could, in theory, be supported by funding through the relevant research council (e.g. BBSRC, EPSRC, etc.) – however it has been difficult to secure funding through these sources due to the highly applied nature of forensic science.

4.1.3 Fundamental scientific research (such as that referred to in 3.1.2) is not ‘forensic’ science, per se, unless its applicability to the criminal justice sector is considered and embedded in the research design. This requires interdisciplinary research teams and methodologies, which are not particularly well-suited to standard research council funding schemes. UKRI could play an important role in coordinating more cross-council funding to support forensic research (e.g. BBSRC/ESRC co-funded calls) and providing funding that speaks to the interdisciplinary and highly applied nature of forensic science research.

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6 Based on the experience of author Smith, who is the current Editor-in-Chief of the Elsevier journal Science and Justice
4.1.4 A significant limitation for forensic researchers based in universities has been the lack of appropriate Unit of Assessment (UoA) in the Research Excellence Framework (REF) for forensic science research outputs. Due to the importance of the REF for institutions and individual research careers, this serves to discourage forensic science research in some cases. This is particularly the case for truly interdisciplinary projects involving social scientists working with physical and/or biological scientists, where neither of the collaborators’ home UoAs are likely to fully appreciate the contribution made by the outputs.7

4.1.5 Another area of opportunity for UKRI funding to support forensic science research is through international development funding, such as the GCRF programme. Forensic science has a significant role to play in improving criminal justice responses (and national and international prosecutions) in DAC-list countries, as well as conflict and post-conflict settings and humanitarian emergencies8.

4.2 Where are the gaps in research and understanding of forensic science? How and by whom should the research questions be articulated to fill these gaps?

4.2.1 In the field of forensic genetics, the gaps are in the use of new DNA-sequencing technologies, across all species, to be used in the investigation of crimes. A metagenomic approach to sequencing, combined with high-performance computing analysis to understand the data, could provide the UK once more with a leading role in forensic genetics/genomics, providing a multidimensional approach to crime-scenes.

4.2.2 Further research focusing on human factors and the cognitive nature of expertise is required and applicable to the full range of forensic disciplines. This research would not only enhance our understanding of decision making about forensic evidence in the context of both expert analyses and the courtroom, but would also improve recruitment, training and proficiency testing of experts working in the criminal justice sector. To this end, largescale ground-truth databases require development and would ideally be centrally coordinated and managed with access provided to researchers, police agencies and FSPs.

4.2.3 National and international bodies such as the Chartered Society of Forensic Sciences and the International Society for Forensic Genetics have the expertise to articulate research questions, together with UK universities who are engaged in forensic research currently.

4.3 How can a culture of innovation in forensic science be developed and sustained?

7 In our experience the social science UoAs tend to find these outputs ‘too scientific’ and the physical/biological science UoAs do not value the applied nature of the research.

4.3.1 Many science funders have been obsessed with human health, but societal health and resilience depends on criminal justice systems that support accountability in complex societies. We believe that promoting forensic science innovation via the idea of translational science for the health of societies is the way forward. Funding streams for these interdisciplinary areas need to be built and made available long-term via UKRI.

4.3.2 In addition to funding for research projects via UKRI (ideally involving more cross-council calls), support for interdisciplinary research centres and doctoral training programmes would ensure a healthy pipeline of forensic expertise and collaboration is sustained long term. These programmes should require co-development of research priorities involving academics, police agencies, FSPs, and legal practitioners.

4.3.3 In order to create and sustain a culture of forensic science research within universities, future REF cycles need to consider how forensic research outputs are evaluated across disciplines. It remains to be seen how forensic research will perform in the upcoming REF2021 (with the implementation of a ‘forensic science identifier’ to be used across output UoAs⁹), but it is difficult to see how universities and individual academics will justify investment in forensic science research if it is not adequately assessed in research excellence frameworks.

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⁹ HEFCE (2017) REF2021: Decisions of staff and outputs
http://www.ref.ac.uk/media/ref,2021/downloads/REF%202017_04%20Decisions.pdf