Dr Anna Williams and Professor John Cassella – Written evidence (FRS0024)

Submitted by Dr Anna Williams and Professor John Cassella, on behalf of the colleagues listed below:

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- Professor John Paul Cassella, Professor of Forensic Science Education, Staffordshire University
- Professor Lorna Dawson, Head of Forensic Soil Science, The James Hutton Institute, Professor of Forensic Science, RGU, Treasurer, IUGS IFG, Committee Member of the Forensic Geoscience Group, Geological Society of London, SEFARI Advisor, Scottish Government
- Professor Patricia Wiltshire, Visiting Professor, University of Southampton
- Professor Lystra Hagley-Dickinson, Head of Department, Criminology and Social Sciences, Plymouth Marjon University
- Mr Ian Arrow, HM Senior Coroner for the Plymouth, Torbay and South Devon Area. Senior Vice President of the Coroners Society
- Dr Martin, Head of Parasites and Vectors Division, Natural History Museum
- Dr John Troyer, Director of the Centre for Death and Society, University of Bath
- Dr Alastair Ruffell, Reader, Queen’s University Belfast
- Dr Jennifer Miller, Senior Lecturer in Forensic Science, Nottingham Trent University
- Dr Chris Rogers, Senior Lecturer in Forensic Science, University of Wolverhampton
- Dr Katherine Brown, Senior Lecturer in Forensic Science, University of Portsmouth
- Dr Kirstie Scott, Lecturer in Forensic Bioscience, Liverpool John Moore’s University
- Dr Noemi Procopio, Lecturer in Forensic Science, Northumbria University
- Dr Ian Bull, Research Fellow in Analytical Chemistry and Head of the National Environmental Isotope Facility (Bristol Laboratory), University of Bristol
- Dr Chris Hiley, Course Director BSc (Hons) Forensic Investigations, Coventry University
- Caroline Sims, Earth2Earth Forensic Osteoarchaeology
- Mr Martin Grime, Honorary Research Fellow, School of Law, Forensics and Policing, Staffordshire University, and Honorary Research Fellow, Nottingham Trent University School of Science and Technology, Nottingham Trent University

Executive summary
We are a group of individual forensic scientists and academics based at UK Higher Education Institutions, with expertise which spans a variety of disciplines: forensic taphonomy (decay and decomposition); forensic anthropology (skeletal and decomposing human remains); forensic entomology (insects); forensic geology (soil, sediment, water); forensic botany (plants, pollen, diatoms); forensic chemistry; forensic biology; and forensic trace evidence (fibres, paint).
We would like to bring two key issues to the attention of the committee: (1) the potential benefits to UK forensic science of a “forensic cemetery” or Human Taphonomy Facility (HTF) in the UK, and (2) the importance of sustained funding opportunities in taphonomy research if we are to be able to offer continued assistance to Police practitioners in the investigation of forensic cases.

We therefore wish to address this enquiry, using the same question numbering system as given in the enquiry guidance (some questions omitted):

1. **Is forensic science contributing to the delivery of justice in the UK?**

Accurate and reliable forensic science is fundamental for the delivery of justice in the UK. The criminal justice system cannot function without high quality, robust, unbiased forensic science. Some areas of forensic science in the UK are relatively well-funded (DNA, fingerprints), but there are some disciplines of forensic science that have been significantly under-funded and the development of which has been hampered as a result. Our understanding of how human cadavers decompose in different environments (e.g.: burial, lying on the ground surface, or submerged in water) in the UK is compromised by the lack of a suitable facility in which to use donated human cadavers for forensic science research.

2. **What are the current strengths and weaknesses of forensic science in support of justice?**

   **Strengths:** In many forensic science disciplines in the UK, it is possible to do rigorous scientific experimentation to test hypotheses. For example, the interpretation of DNA evidence is strong, and is based on observation and analysis by discipline experts. This gives the judiciary confidence in the evidence presented in court.

   **Weaknesses:** However, the privatisation of forensic science provision in England and Wales has made it a commercial venture in some organisations, and often less subject to academic scrutiny, which can compromise the integrity of forensic science in the courtroom. The lack of evidenced-based research in forensic taphonomy is hampering its effectiveness and use.

3. **What is the scientific evidence base for the use of forensic techniques in the investigation and prosecution of crimes?**

Currently in the UK, the scientific evidence base for our understanding of how a decomposing cadaver interacts with its environment, for the search and location of missing people, the identification of unknown remains, and the estimation of post-mortem interval (PMI) is: anecdotal evidence; comparison with published cases; interrogation of published literature from research on human remains from existing HTFs around the world; and from animal-based (mostly pig carcasses) decomposition research in the UK. This means the evidence is compromised, as the data from other countries is not directly applicable to UK forensic cases, and the data generated by experiments on pig carcasses is not always directly applicable to human beings. Thus, there is a real need for well-funded, evidence-based research in this area to be undertaken to provide greater confidence in outputs from this forensic sub-discipline.
4. How can the Criminal Justice System be equipped with robust, accurate and transparent forensic science?

Forensic science outputs (research papers, statements, case reports) need to be monitored by independent and impartial third parties. The National Crime Agency (NCA) currently has an Expert Advisors database, which does give some checks/balances of practitioners undertaking cases/outcomes etc., but not all practitioners are listed. Much work in this discipline is by personal recommendation or previous experience, which is not ideal. Enhanced channels of communication between scientists, lawyers and the judiciary may also be of immense benefit to the Criminal Justice System as a whole.

5. What is the level of understanding of forensic science within the Criminal Justice System amongst lawyers, judges and juries? How can it be improved?

In our field, the level of understanding can be limited, or biased by what is available in popular media. Training and/or awareness courses, particularly covering the limitations of the scientific evidence in these areas, would be very beneficial. These courses could be delivered at a “forensic cemetery” or Human Taphonomy research and training facility.

6. Is the current training available for practitioners, lawyers and the judiciary appropriate?

Some training courses are provided for police, forensic science students and others for search and location and excavation of remains, by the College of Policing and some universities. However, these courses invariably use porcine remains instead of human remains, which means that some practitioners may not see a cadaver until they are operational. Exposure to the sights, sounds and smells of human decomposition on training courses at a HTF would be valuable in helping practitioners come to terms with the situation in a secure environment without peer pressure or fear of damaging evidence. A “forensic cemetery” or HTF can provide training courses on search and location of human remains; recovery and excavation of human remains; recovery of trace evidence from human remains; human/animal identification; training for victim remains detection (VRD) dogs and handlers. As far as we are aware there are currently no bespoke courses about human (or animal) decomposition and identification for lawyers and the judiciary.

8. Is the system of accreditation working successfully to ensure standardised results and the highest quality analysis and interpretation of significance of evidence?

The accreditation system for forensic anthropologists in the UK is not as robust as it could be. There have been recent advances to encourage practicing forensic anthropologists to submit evidence and casework through the Royal Anthropological Institute (RAI), but the uptake has been far from nation-wide. The National Crime Agency has an Expert Advisors database, but as mentioned earlier, not all practitioners are listed or engage with it.
In the area of forensic anthropology, there is little standardisation of results, analysis or interpretation. Much analysis is known to be subjective, and much of the reference data are unrepresentative of modern populations. However, Codes of Practice for Forensic Anthropology have recently been published by the RAI, which is a positive step. However, these Codes of Practice do not address the importance of taphonomic assessment.

10. What lessons can be learned from the use of forensic science in Scotland and Northern Ireland? What can be learned from the use of forensic science overseas?

Human Taphonomy Facilities using donated human cadavers to undertake forensic research and training have existed in the USA since 1981. Since 2005, eight more facilities have been created in the USA, Australia and the Netherlands, and more are being planned in Belgium and Canada. The research undertaken and the data generated at these facilities have directly impacted on the successful search and location of missing human remains, convictions of perpetrators and the identification of unknown victims of crime or disaster, in the USA and Australia. A precedent has been set by these facilities abroad which demonstrates their value for forensic science.

The existence of these HTFs in other countries means that those wishing to establish a HTF in the UK can learn from their experience and success. There are existing protocols, SOPs and literature regarding the day-to-day facility operation, including best practice on ethical issues, donation, family liaison and advice for local communities and religious groups. These are respected scientific establishments and have long ‘waiting lists’ of pre-donors due to strong public support of the schemes.

12. How should further research funding for forensic science be justified? What should be the focus of such research?

The Government is committed to reducing crime, creating a safe environment and fighting terrorism on our shores and the research should be focused on these objectives. Access to a “forensic cemetery” or HTF in the UK would help meet the overall aims, helping provide better criminal investigation, more confidence in the interpretation of results and increasing the likelihood of correct convictions in forensic cases.

Key elements required are:

- Improve success rate of finding missing people or victim remains from disasters/terrorism/mass graves/murders.
- Improve the likelihood of positively identifying unknown remains once located.
- Improve the reliability and accuracy of PMI estimation; improving the confidence in PMI estimations in court.
- Improve potential of finding valuable information from trace evidence found in association with decomposing remains, in order to identify criminals.
• Improve the successful operation of VRD dogs, reduce the likelihood of false positives, and improve the reliability and accuracy of VRD dog evidence in court.
• Improve the likelihood of finding and identifying victims and criminals in cold cases.

13. 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?

There are significant gaps in our understanding of the interaction of human cadavers and the environment. Research is required on the following topics, at a “forensic cemetery” or HTF in the UK:

• Identification of the volatile organic compounds (VOCs) that are given off by cadavers in a variety of conditions (e.g.: surface deposition vs buried, in water, burned, frozen etc.), and the implications of this for training of VRD dogs. This is essential to increase the speed and success rate of locating victim remains at disasters such as Grenfell or from terrorist attacks e.g. Manchester Arena.
• The effect of soil type, soil depth and water saturation on human decomposition.
• The persistence of trace evidence (paint, fibres, fingerprints, DNA) on decomposing cadavers in a variety of conditions (e.g.: surface deposition, buried, submerged in water, burned etc.) as a function of time.
• The persistence of products of decomposition and associated biomarkers in different soil types, for search and location purposes.
• The effect of the burial of multiple human cadavers on the local ecosystem, including plants, insects, scavengers.
• The effect of UK scavengers, vertebrate and invertebrate, on identification of decomposed human remains.
• The effect of human conditions such as smoking, drug/medication use, diet and exercise, sex, ancestry, body size, and diseases/conditions such as diabetes, cancer, autism, Alzheimer’s etc. on decomposition rate, to improve PMI estimations.
• The behaviour of cadavers in different bodies of water, and the effect of the temperature, salinity, depth, movement/currents on this behaviour.
• The true insect assemblages associated with human cadavers in different environmental conditions, and their developmental parameters, for estimation of post-mortem interval.

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

A culture of innovation can be developed through encouragement and nurturing of this type of research, provided by sustained funding, including PhD funding not restricted to Doctoral Training Centres (very few exist for forensic science). True innovation is about taking steps that others have not in order to provide much needed solutions. The sound precedent set in the USA, Australia, the Netherlands and now Canada proves that, across the globe, access to a Human Taphonomy Facility of “forensic cemetery” is seen as an essential scientific
requirement. Only with forward thinking and essential funding can forensic science innovation in the UK match that of our international peers.

15. Are there current or anticipated skills gaps? Who should have responsibility for and/or have oversight of training?

There are distinct areas of training and skill sets that are currently missing in UK forensic science which could be easily addressed. A “forensic cemetery” or HTF could operate as a national resource to fill these gaps, taking responsibility for training of police, military, forensic students, lawyers and the judiciary in the following areas:

- Search and location of human remains in a variety of conditions, including water.
- Excavation and recovery of human remains to minimise loss of evidence.
- Training, competency testing and licensing of VRD dogs, handlers and instructors (police, military or civilian).
- Triage of animal vs human remains.
- Identification of human remains (osteology, odontology, fingerprints, facial recognition etc.).
- Analysis of trace evidence in association with human remains (clothes, firearms, mobile phones, paper, plastics, fibres, insects, etc.).

These topics could be addressed with funded research using the controlled, laboratory conditions that a “forensic cemetery” or HTF would provide. Without access to such a facility in the UK, forensic scientists are unable to assess and consider the effect of the climate, insects, soils, and scavengers on human decomposition, to make the data generated directly applicable to the investigation of forensic cases in the UK. If a “forensic cemetery” or HTF is not initiated soon in the UK, then we as a scientific community must accept that we are falling behind the rest of the world in our ability to provide and perform meaningful forensic taphonomy research.

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