THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DEBATE SUMMARY

Using science to authenticate, verify or assure the identity of people and things

Held at The Royal Society on 2nd March, 2016

The Foundation is grateful to The Michael John Trust and The Wellcome Trust for supporting this debate.

The hash tag for this debate is #fstidentity .
Audio files of the speeches are on www.foundation.org.uk .

Chair: **The Earl of Selborne GBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **Sir Mark Walport FRS FMedSci**
Government Chief Scientific Adviser, Government Office for Science
Dr Derek Craston FRSC
Government Chemist and Chief Scientific Officer and Managing Director, Science and Innovation, LGC
Professor Sue Black OBE FRSE
Professor of Anatomy and Forensic Anthropology and Director, Centre for Anatomy and Human Identification, University of Dundee

Panellist: **The Rt Hon the Baroness Neville-Jones DCMG**
House of Lords

SIR MARK WALPORT said that in his 2015 Annual Report[1] he had focussed on forensic science. Forensic science was applicable to far more than court proceedings; it was vital for providing evidence for policy, creating resilience in infrastructure and developing emerging technologies. New factors were the ability to trace minute substances, consumer demands for quality and provenance and the whole field of identity and verification in cyberspace. We need to know the identity of our correspondents, the authorization they have to act and the provenance of the goods they sell. Cyberspace is global; regulation is difficult. Securing the assurances we need demands innovative technology. Apart from cyberspace - even though that is the largest growing area of criminality - the large scale of fraud in pharma products can be seen from the WHOs Medical Products Counterfeiting Task force - which showed that 25% of medical supplies to less developed countries were counterfeit.

Forensic evidence is vital to link persons to places and incidents, to develop new classes of evidence, and to deter criminal activities from arising. Policy makers and practitioners must work together - with a consistency of approach, full communication, a common set of standards, full collaboration across disciplines, and clarity of purpose. We must seek to assure that supply chains are properly regulated and regulations enforced. Forensic science has a long history in designing or marking items so they are more difficult to steal, and less valuable when stolen.

New technologies are developing - such as distributed ledger technology using block chain which can mitigate the threat of insider intrusion, protect control systems in critical infrastructure and verify supply chains. There are novel emerging techniques which present opportunities and challenges. Biometric recognition techniques are one. For these techniques to be successfully used, we must understand the public values - such as privacy - which may be infringed, build trust about how and where and by whom these techniques are used, and be confident about their reliability. We need a forum to discuss these issues, which go far beyond the justice system, to establish confidence in their use. Summing up, forensic science draws on almost every discipline, innovation can come from anywhere and if applied appropriately will increase confidence in the use of forensics and create new business opportunities.

DR CRANSTON endorsed Sir Mark's view that forensic science had utility well beyond the courts. Establishing the authenticity of goods had a long history (in 160BC 50% of wine was being adulterated to avoid taxes) and we still remember the horse meat scandal of 2013. The scale of the market for forensic science is enormous - £250bn - to ensure authenticity in pharmaceuticals, food,

[1] GCSA 2015 Annual Report – see below for URL

clothes, cosmetics or spare parts. Use of the internet - 15% of retail transactions are now web based - and complex lengthy supply chains, with no regulatory requirements in some countries and for some products, adds problems. Innovation was essential to deal with these issues.

We need to be able to reformulate complex products to determine origin and components; we need to be able to detect very low levels of chemicals. Whereas we used to detect an impurity in only a flask of water, we can now identify it in a reservoir, but we still have to decide what the observation value tells us? Is it merely an excursion from the mean? These questions affect both our behaviour and the environment. So we need to understand the constraints on the interpretation of evidence, particularly how to communicate the uncertainty of a measurement.

The use of large data sets increases the value of innovative techniques. Managing supply chains, developing new products about which markets can feel secure, deterring crime are among the values of forensic science.

PROFESSOR BLACK defined forensic science as the discipline of disciplines, as all disciplines could use and be used by it; it had the potential to challenge people to move between disciplines, breaking down silos and encouraging multidisciplinary innovative research. Moreover it was easy to communicate with the public about it and encourage SMEs to use the tools used in forensic science. Forensic science had a "Medici effect" or "Enlightenment context" i.e. it provided a backdrop which promoted innovation in all sorts of different areas because barriers were broken down and ideas shared. It creates a different mind-set for innovation.

Innovation can be difficult and risky if confined to a single discipline; shared ideas from different disciplines encourage innovation, as deep and wide networks are established. Forensic science does not need a separate funding stream, so it does not raise fears that other funding streams might be tapped. By its very nature, forensic science goes well beyond the courtroom into all aspects of scientific work. Its role is to change behaviour so that scientists do not look only at their own discipline and see results in only a small area of policy or activity. Sir Mark's report is exciting in that it offers us opportunities of new ways to encourage innovation and extend the use of scientific methods to a whole new range of sectors.

BARONESS NEVILLE-JONES opened the following discussion. She endorsed the speaker's views, but thought the translation of new technology into public policy was difficult and lengthy. The challenge of creating genuine interdisciplinary activity was great; a triangular relationship between public and private sectors and academics was essential. We needed to get big companies involved as we did in the past. Governments did not work well with SMEs. Government procurement and regulation for innovative techniques was essential, but difficult as there could be failures with immature techniques. We must also accept that criminals will inevitably use new techniques for their own benefit. Building up trust in the use of new techniques was essential. Distributed ledgers could be valuable in creating secure databases.

In the following discussion, speakers were concerned about the continuing absence of common understanding and trust between scientists and judges - it was as if the "two cultures" identified by C.P. Snow still existed. The Royal Society was working with the judiciary to bring together judges and scientists to discuss scientific issues and their use in the courts; neuroscience, probability and capacity were among the subjects.

Businesses also had an interest in the common problems of reducing propensity and ability to undertake criminal acts, and secure appropriate convictions. Managers, too, often did not meet scientists and it was important to bring them into the circle. Professor Black's comments about silos rang true - scientists often did not meet not only non-scientists but also scientists working in other disciplines. It was important that they considered applications of their own specialities in other fields and how they could be utilized effectively in public policy. Fora should be established which encouraged this interaction, and they should be open as widely as possible, both to develop trust amongst wider groups in society and to enable new and unconventional views to be aired.

Although the higher judiciary were sympathetic and welcoming about the use of innovative forensic techniques in the courts, particularly where there was a sound basis for their use, there was still a feeling that many judges were over cautious in advising juries on their acceptability and the Crown Prosecution Service was nervous about using them in deciding on prosecution. Speakers noted that the French had a system of regulating use of forensic techniques, which pre-empted discussion in court of their suitability; would it be right to establish such a system in the UK? But to establish a sufficient data base and evaluate a technique for regulation took much time and cost; who will pay? The answer is to look at the global market, as speakers had said. Forensic techniques do not apply only to the court room; they are vital to all business worldwide, and there must be companies wanting to help pay for their development. But we must be aware of attempts to sway evidence, and not ignore those criminals who would use these techniques for their own purposes. Cognitive bias could also affect the use and validation of techniques.

The trail between evidence and its use in court is long. The evidence must be collected, kept, transported, ensured to be of good and consistent quality, and explicable to judge and jury. Firm oversight is needed at every step; the scientific justification for its use should always be evident; perhaps a working party on justice might help.

Using innovative forensic techniques could delay, or complicate proceedings, as well as benefit them.

The police were now well aware of crime in cyberspace, but needed to achieve a higher level of prosecution. Biometric techniques could be very valuable but their use raised questions of their computability with public values, such as privacy, and trust in their use. Uncertainty about the use of new techniques is inevitable - things can sometimes go wrong.

It has to be clear who has the information and when it is proper for them to use it. The current case in the USA that demands that Apple should unencrypt an iPhone is an important test case. Should Apple access encrypted data at the request of the FBI or argue that doing so would lead to a loss of trust by the public in the use of Apple devices?

Do we know who has access to the fingerprint image used to open a phone or other devices and what use can be made of it?

Mobile phone technology particularly in Africa is providing new ways to track identity of people and products.

New technology could be used to authenticate drugs at the point of sale to decrease the proportion of counterfeit drugs in circulation. The UK was being very slow in adopting such technology.

Technology was evolving much faster than the legal framework. A new industrial revolution was underway that needs 'smart' regulation.

DNA fingerprinting techniques still have plenty of scope for improvement.

Conclusions from the discussion were:

- forensic science cuts across many disciplines and has application in many new ways beyond solving crimes;

- there are many complex ethical and trust issues to be resolved;

- establishing identity in cyber space presents many challenges. New technology such as block chain techniques will help but training programmes to enhance skill levels will be required.

Sir Geoffrey Chipperfield KCB

Open this document with Adobe Reader outside the browser and click on the URL to go to the sites below.

REPORTS:

Distributed Ledger Technology: beyond block chain, Government Office for Science, January, 2016
www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf

Forensic Science and Beyond: Authenticity, Provenance and Assurance
Annual Report of the Government Chief Scientific Adviser 2015
www.gov.uk/government/publications/forensic-science-and-beyond

National Audit Office Report on The Home Office's oversight of forensic services, January, 2015
www.nao.org.uk/wp-content/uploads/2015/01/The-Home-Office's-oversight-of-forensic-services.pdf

House of Commons Select Committee on Science and Technology: Forensic Science, July, 2013
www.publications.parliament.uk/pa/cm201314/cmselect/cmsctech/610/610.pdf

Research and Development in Forensic Science Review, Professor Bernard Silverman, June, 2011
www.gov.uk/government/publications/research-and-development-in-forensic-science-review

USEFUL LINKS:

Academy of Medical Sciences
www.acmedsci.ac.uk

AEGATE – The Medicine Digital Network
http://aegate.com

AIRTO
www.airto.co.uk

Biotechnology and Biological Sciences Research Council
www.bbsrc.ac.uk

Border Agency
www.gov.uk/government/organisations/uk-border-agency

Department for Business Innovation and Skills
www.gov.uk/government/organisations/department-for-business-innovation-skills

Defence Science and Technology Laboratory (Dstl)
www.gov.uk/government/organisations/defence-science-and-technology-laboratory

DNV GL
www.dnvgl.com

Economic and Social Research Council
www.esrc.ac.uk

Engineering and Physical Sciences Research Council
www.epsrc.ac.uk

Food Standards Agency
www.food.gov.uk

Government Communications HQ (GCHQ)
www.gchq.gov.uk

Government Office for Science
www.gov.uk/government/organisations/government-office-for-science

Home Office
www.gov.uk/government/organisations/home-office

Home Office Centre for Applied Science & Technology
www.gov.uk/government/collections/centre-for-applied-science-and-technology-information

Innovate UK
www.innovateuk.gov.uk

LGC
www.lgcgroup.com

Lloyd's Register
www.lr.org/en

Medical Research Council
www.mrc.ac.uk

Ministry of Justice
www.justice.gov.uk

Natural Environment Research Council
www.nerc.ac.uk

National Physical Laboratory
www.npl.co.uk

Research Councils UK
www.rcuk.ac.uk

Royal Academy of Engineering
www.raeng.org.uk

The Royal Society
www.royalsociety.org

The Royal Society of Edinburgh
www.royalsoced.org.uk

Science and Technology Facilities Council
www.stfc.ac.uk

University of Cambridge
www.cam.ac.uk

University of Dundee - Professor Sue Black
Centre for Anatomy and Human Identification
www.cahid.dundee.ac.uk/staff/sue-black

Universities UK
www.universitiesuk.ac.uk

The Foundation for Science and Technology
www.foundation.org.uk

A Company Limited by Guarantee
Registered in England Number: 1327814
Registered Charity Number: 274727