Summary of talks at the ESRC research seminar 3: Comparing the use of DNA in criminal investigations &DVI across European borders

ESRC Research 'Seminar series on genetics, technology, security and justice. Crossing, contesting and comparing boundaries'

Thu, 14 July 2016, 12:00 – 18:00 and Fri, 15 July, 09:00 – 14:00, Northumbria University, Great Hall, Sutherland Building, College Street, Newcastle upon Tyne, NE1 8ST, UK

This 2-day seminar discussed cross-jurisdiction uses of genetic technologies in criminal justice and disaster victim identification (DVI), including the role of the UK and other member states as collaborators and within the EU. This summary was collated by ECR bursary holders Emma Johnston and Fabio Oldoni.

DAY I

Session I

The situated realities of forensic un/certainty and political remains (Dr. Lucy Easthope, Lincoln University)

Dr Easthope began her talk by acknowledging the work of the UK based charity Disaster Action. She went on to explain that the why of forensic intervention is becoming a growing area of critique and evaluation especially now that the "DNA genie has been let out of the bottle". Dr Easthope has a wide range of experience in the field of DVI including Operation Keir (the Brize Norton mortuary) and providing DVI guidance internationally. While an appropriate forensic science strategy will be set on day one of a DVI operation, it is a myth that it is known in advance what will be done. It is not a pre-ordained path. Mistakes will be made. There is indeed the need to look for different ways to incorporate feedback into practice.

DVI international policy has significantly changed post-DNA and DNA analysis is now considered as the ultimate identifier tool; everything else is contextual. New concepts of recovery have emerged as demonstrated by the Air France disaster where there was a massive effort to recover everything and this raises questions around choice and opt-out for families in DVI.

Dr Easthope then presented results of her research - She compared the DVI investigations into the 9/11 attacks and the Lac Megantic (LM) rail disaster in Quebec in 2013 and conducted a detailed ethnography into the latter. 9/11 has been a perpetual intervention; some families have received more than eleven contacts regarding new identifications of body parts. Misidentification should be avoided in such circumstances.

Whereas with the LM disaster there was an end point: it was decided on day three of the investigation that a large pile of debris would not be searched for everything.

The Lac Megantic case represented a return to more "old school" DVI (such as dental record) that allowed an endpoint. There were identifications where DNA failed and this allowed the community to rebuild. This raises some interesting questions. For example, in the MH370 case there were no remains, what do we do? (this could be an interesting area of interdisciplinary research). Personal effects become totemic. Is it worthwhile to make use of massive advances in DNA technology to bring a closure to those families who are desperately seeking for truth for their beloved? What do families see as identification, do they need a DNA profile match? How can we communicate uncertainty in forensic science and balance this with public expectations? What are the boundaries of such a process? DVI as an industry- should it be?

Validation and verification under ISO/ IEC 17025:2005. What does this mean for forensic DNA software? (Dr. Chris Maguire ForGenetica Cons Ltd.)

In the UK there is a requirement for private forensic science providers (FSP) to be able to demonstrate their adherence to the ISO17025 standard for the services they deliver. The Forensic Regulator has started that the same standards should apply to those police forces that have 'in house' forensic science provision. UK police laboratories were meant to have obtained ISO17025 accreditation by 2013 but this is now not expected to be completed until 2020.

In fields such as DNA profiling, the interpretation of the analytical results is also subject to the accreditation process. As techniques become more complex, the analytical processes are increasingly involving advanced modelling software. For example, an FSP might use LRmix, STRmix or TrueAllele to support DNA mixture analysis, or Familias, Boneparte or GPS-ibd for DNA-based relationship analysis or familial searching.

Dr Maguire's presentation tackled the question of how such software applications might be validated under ISO 17025? Is this necessary and what does this mean for providers and users of forensic DNA software applications?

In their paper on the validation of DNA interpretation software, Gill & Haned proposed three steps towards validation: (i) development of the mathematical Model, (ii) Conceptual Validation (demonstrating the application follows the mathematical concepts underpinning the model), (iii) Software Validation and operational verification. Dr Maguire is of the opinion that this is a clear statement of the issue and provides a reasonable approach to its resolution. He is of the opinion that software manufacturers should supply the validation and consumers carry out the operational verification.

Dr Maguire was heavily involved in the development and testing of GPS-ibd, software

developed from the historic FSS-ibd application. It is used for relationship analysis and cases involving human identification (DVI) and familial searching of DNA databases. Dr Maguire described the validation of this software and the operational verification of the application by Dr Clayton and Dr Puch-Solis of LGC. A series of pedigrees of increasing complexity were tested and the manually derived results compared with those generated by GPS-ibd. No differences were detected in the results. LGC presented the software validation carried out by Dr Maguire and the results of their operational verification to UKAS as part of their application for accreditation of their relationship analysis service. The application was successful and the LGC relationship analysis service using GPS-ibd was accredited by UKAS under the ISO17025 standard.

Discussion/ Questions

Is accreditation too hard? Should we be doing it?

Absolutely, the forensic community needs to work towards standards and all should be done in a cost-effective way.

If we struggle with getting DNA reference profiles for DVI, isn't there an argument for taking DNA from all new-born babies?

Actually blood is taken from new-borns in the form of heel-pricks and this material has been used for identification purposes in certain cases in the past. Proper request and strict biometrics rules are peculiar for some countries.

Getting the DNA is not necessarily the main issue, but where and when do we need to stop is.

A case example was given of an aircraft crash and DVI of two victims. To perform the DNA analysis on all recovered body parts material would have cost ¾ of the police force's annual budget. In the end they identified 139 recognisable body parts. After 7/7, the decision to process only recognizable body parts in an effective fashion was taken and the line was drawn at body parts $5mm^2$.

What would be a good point to stop DVI?

We have to stop somewhere and the Home Office agrees. It's therapeutic. There is traction in the community for the idea of an endpoint. The decision about an endpoint needs to be made at the outset of the investigation. Do we cremate the residual tissues? This may raise conflicts and issues with the faith of victims/ families.

In the MH17 case there were thousands of body parts. Two victims remain unidentified. The efforts will continue until everyone is identified or there are no more body parts.

<u>Session II</u>

Theory and bodies out of bounds: A reflection on identity politics and thanatocracy (Dr. Claudia Merli, Durham University)

Dr Merli was present in Thailand, carrying out fieldwork, when the 2004 Indian Ocean Tsunami struck. This experience impacted on her both personally and professionally and she presented her work and experience in relation to this disaster.

The number of dead from the tsunami is an estimate only. It has been estimated that more than 250,000 people lost their lives. Thailand had the lowest number of dead but the largest DVI effort. 30 international DVI forensic expert teams took part in the DVI investigation. The deaths were out of place both spatially and conceptually, as many were tourists. This meant they couldn't be dealt with as "normal" deaths. There were many issues concerning definition and management of populations, places and identity politics. These included natural (or political) processes and selection of places to be buried, i.e. westerners were individually identified and repatriated but Sri Lankans were placed in mass graves. There was a sort of separation between Asians and Western bodies (tracing macro-ethnic boundaries). Locals did not necessarily identify the deaths as natural. In relation to identity politics, individual bodies were associated with nation bodies.

"Death specialists" arrived in Thailand from abroad. Various humanitarian agencies were involved and provided rescue and recovery teams as well as volunteers and forensic forces. There were distinct differences in the treatment of bodies and the main methods of identification (pictures of victims, fingerprints, dental records, DNA). Themes that emerged include: necropolitics, biocracy (authority of verification through bureaucratic actions), and thanatocracy.

Dr Merli identified four key steps from biopolitics (politics of conduct of life) to thanatocracy (association of military, scientist and businessman):

1. Technical problems (for instance lack of refrigeration/storage)

2. Standardisation of conducts (of both experts and bodies)

3. Lost distinct identities and new homogenous death population

4. Thanatocracy

A new definition of thanatocracy was also proposed, as mass death reframed as an eminently bureaucratic phenomenon.

When humans and technologies cross borders: Identifying refugees around the

Mediterranean Sea (Prof. Amade M'charek - University of Amsterdam)

The presentation paid attention to the refugee crisis in the Mediterranean. There is paucity of information on those refugees who died attempting to cross and reach the southern borders of Europe. Numbers are very difficult to come by and are rising. There is much more monitoring of those who arrive, but not of those who do not. The Deaths at the Borders Database is one source of information. There are many ways of attempting identification but it seems that many bodies are being buried in anonymous mass graves without registration or documentation (certainly the experience in Tunesia). The duration of the mass disaster is unique in being so prolonged. A novel forensic infrastructure on how to coordinate different technologies including DNA analysis, dental record analysis and classical anthropology is needed. This is not new in terms of technology but rather in terms of co-operation. Alternative methods should be considered:

- Using social media records to aid identification (as in a project by Prof. Cristina Cattaneo, LABANOF, University of Milan).
- Fishermen in Tunisia are acting as first responders. What experience do they have? They are able to tell from currents where a body might have come from and when it may hit the shore.
- The International Committee of the Red Cross has run a project "I am looking for…" which publishes of photos family member looking for loved ones (depiction of a poster displaying information on victims).

What forensic infrastructure is needed? How can we incorporate all the different areas of expertise? Identification is the price we pay for protecting our borders.

Discussion/ Questions

Misnomer of DVI- the commercial/ single nation (colonialist?) interest no longer fits. Humanitarian aspects fall into the vacuum. What does the future look like?

Where is the end point? We will not ever be able to identify all decedent migrants but we need a good enough solution that shows sufficient care & attention to the victims. There should be space for variety, recognising different cultures and economic positions. There will never be single, one-size-fits all approach.

Following the tsunami, international DVI teams focused only on identifying their own victims. There is the privilege of electronic dental records for westerner's compared to East Asians whose paper-based dental records were washed away by the Tsunami struck.

If people are fleeing conflicts, how do we refer back to the source country? Assumptions

made about the DVI need to be disrupted. The apparatus does not fit this context.

Nationality- migrants killed in shipwreck off Italy became naturalised Italians.

Where do we focus? Here in Europe because it is on our doorstep or in Sub-Saharan Africa?

In the Netherlands unknown individuals are buried but DNA is taken first, care.

There is no entitlement to identification or even certain care/ rituals.

Session III

DVI practices after the 9/11 WTC tragedy: protocols, experts and victims' families (Dr. Victor Toom, University of Frankfurt)

Dr Toom carried out interviews with families, scientists, clergy and disaster responders who were involved in the 9/11 attack in New York City.

Closure is often mentioned in DVI practice but one family member told Dr Toom that "there is no such thing as closure". What is closure? It is difficult to find a single definition. One possible definition is "the ability to put trauma behind you and reach an even keel". Is there the need of a body to have closure? Perhaps closure is a made-up concept to normatively prescribe how we should feel and behave when dealing with loss.

Dr Toom did not ask whether interviewees had found closure or even what it meant to them. He became interested in rituals and how WTC victims' families invent rituals in the wake of 9/11. There has been a long delay (several years) post-9/11 in identification. The 9/11 attack made 2,750 victims and a total of 22,000 human remains. 60% of the victims were identified whereas 40% remained unidentified to date. Nonetheless, new identifications are still being made. The idea of a burial with a body is important to many family members so that they have a place to go. Knowing the place or circumstances of death also appeared to have an impact on families, as they were able to construct a narrative of the end of their kin. Families yearn for something physical, in some cases it is an urn of WTC dust, in other cases it may be a set of car keys, or even a plastic container with a little bit of DNA; in the absence to bury any remains, families would organise a burial without a body but the coffins containing objects that represent the individual.

There is a distinction in grieving practices between families of identified victims and those remaining at large who have no ceremony, no certainty, and these families often live between denial and hope.

DVI practices should hence not be aimed at achieving closure, but at facilitating the tasks and process of grieving.

Processes and cooperation in forensic DNA for investigation and identification (Dr. Ingo Bastisch, German Federal Police Agency)

The German law-based approach to identification is highly regulated and its use is decided by courts, police and prosecution and takes into account the type of crime and the resources needed/available.

Who should be on a DNA database? From an investigative point of view only, an "everyone in" approach is most valuable. However, this would probably not be socially acceptable and would require resources that cannot be justified. In addition, which crime scene DNA samples should be on the database? Only high DNA profile cases or high volume crimes as well? In terms of international DNA matching such as bi- or multi-lateral agreements including Prüm data exchange or Interpol, which profiles should we include, which criminally known people?

Investments in the criminal justice system do not give returns that can be easily calculated. More socio-economic calculations of this type would be useful. International examples show that additional investments are often only done when issues become public. In most countries, we have suitable legal frameworks and quality control processes are well standardized as well as training and education. The use of DNA can be much improved but resources and political priorities seem to limit, to some extent, its use.
In terms of DVI there are difficulties in opting out from an operational point of view. The Tusnami disaster was the biggest DVI process ever put in place. The standardized process worked in general and different proof of evidence such as DNA, dental and fingerprints were equally important in the process of victim's identification. Processes are optimized in a way that everybody should be identified with the biggest chance.

Familial searching is a novel tool applicable to relationship testing analysis through relatives. The usefulness of this approach depends on many factors, e.g. legislation, database structure sample retention etc.

Discussion/ Questions

There was conflict between different agencies in Thailand, especially regarding transfer of bodies. Were international teams aware of this? Yes, to some extent.

Was emotional labour of forensic scientists included in the 9/11 research?

Yes, interviews with several scientists were carried out. Scientists became acquainted with the families over the period of the investigation.

The family organisations were involved in advocacy and scientists arranged laboratory tours, family meetings, answered questions and explained laboratory processes. Though it may have made things emotionally harder for the scientists but it is easier when the families understand. DVI operations should foster working relationship between families and forensic specialist teams.

What is the best instrument for international DNA data exchange?

There are many practical considerations such as sharing borders and languages. For example in Germany, Austria and the Netherlands, Prüm is working well.

Several studies in the USA have shown the economic benefits of DNA profiling. The benefit is around €1000 per stain - suspect match for the Dutch DNA database compared to other evidence types.

Another example was given of a rapid DNA trial in the UK. Three day profiling reduced investigation time by 10 weeks. This reduced the cost of investigating a burglary by around £3300. The scientists in questions took this data to the Home Office and received more funding.

Day II

Session I

Geopolitics and ethical challenges of DNA data exchange in the EU (Dr. Helena Machado, University of Coimbra - Centre for Social Studies)

Dr. Machado spoke mainly about the Prüm treaty, which she is researching from social and legal standpoints as part of the ERC Exchange project. The team is investigating the social, geopolitical and ethical implications of transnational data exchange under the Prüm agreement. Technologies are never ethically or politically neutral. Views and practices of forensic geneticists are being gathered and interviews will be conducted with Prüm National Contact Points in EU countries. The project also involves an ethnographic study and researchers are participating in forensic genetics events; observing communication patterns, flows of knowledge and relations. In addition, to construct a solid credibility of DNA evidence private companies within the forensic genetics arena are also considered. Case studies of Portugal, Poland, Netherlands and the UK will be produced.

The investigation of cross border crimes as facilitated by the Prüm agreement both globalises and localises the use of forensic genetic technologies. Some quantitative data has already been produced, showing that the Netherlands, Slovakia and Austria are exchanging the most data via the Prüm system. A scale of different matching levels including “above”, “below average”, “none operational” or “no data” has been set up. Germany and France account for the top 10% of matches. These countries involved in large-scale exchange of data also have the largest national DNA databases. Available metrics to measure the utility of databases are limited and deeper socio-economic study is required.

Romania and Lithuania have a larger proportion of own person to external stain matches than own stain to external person. This kind of data could lead to criminalisation of Eastern European countries. A new type of trans-national genetic suspect is emerging.

National Contact Pints were asked about the ethical challenges of Prüm. Most seem to place some kind of boundary between their work (at laboratory, crime scene and court levels) and ethics but they show a certain ethical awareness notably around the issue of false positives. Different levels of trust (towards how false positives may be treated in different countries) are observed, leading an exploration of the geopolitics of trust. Ethics are often seen as being something to consider before or after the laboratory stage in the process. The ethics of the Prüm system involve much more than just data protection and there are links with geopolitics. It also encompasses responsibility and custody of DNA databases.

Towards reconstructing DNA-based offending trajectories within and across the borders (Dr. Patrick Jeuniaux, National Institute of Criminalistics and Criminology, Belgium).

In this presentation, Dr. Jeuniaux aims at illustrating the potential (and limits) of studying offending trajectories with DNA database data and examining differences between national and international offending trajectories. To reach these objectives he uses an extraction of the Belgian national DNA database (BNDD) from May 2016. As Belgium is operational within the Prüm scheme, information on transnational offending is available in the database. The Prüm scheme is a decentralized mechanism (i.e., a mechanism that uses no central database) that allows participating countries to automatically exchange data (such a forensic DNA data) with each other. Dr. Jeuniaux has been using Belgian BNDD data to investigate fundamental concepts such as repeat offenders (offenders who offend several times), offending trajectories (i.e., the succession of crimes committed by a same individual), and clusters (i.e., collection of DNA profiles belonging to a same individual). The focus of the analysis is the person rather than the crime itself and a longitudinal approach is taken. This allows the accumulation of knowledge on criminology to influence strategy, policy and operations.

Within the present (Belgian) context, the reconstruction of the true trajectory is difficult as some data is unavailable or difficult to interpret. Using BNDD data means that there is a heavy DNA selection bias and a poverty of Meta data (location, timing, nature of crime). However, using such data also presents advantages: 1) it allows comparing known and unknown offenders, 2) DNA data is highly reliable, 3) it allows studying transnational offending (thanks to Prüm). From this data set there were 7535 clusters (i.e., roughly, individuals). 68% of these had no Prüm match and 32% had a match in France, Germany or the Netherlands. Five individuals were found to have left DNA traces in all four countries (Belgium, France, Germany and the Netherlands). In a deeper analysis of a sub-set of trajectories (5395 clusters), Dr. Jeuniaux found that individuals with international mobility were more specialised (in terms of crime type) than those that did not exhibit international mobility. Moreover, those who were internationally mobile were also more mobile within Belgium as well. However, in general their Belgian activity was close to the border of the country they had a Prüm match with.

Questions/Discussion

How did you determine the crime type categories i.e. no speciality? And how was the category "violence" determined?

If no more than 50% of the crimes committed by an individual were of the same crime type, they were categorised as a non-specialist. Any crime types could be included within this. The violence category included assault, assault with a weapon, threat.

Need to be careful with the data on NDNADs as many people on the database are not from that country e.g. Prüm match with Netherlands but person may not be from the Netherlands, just on their DB. Also need to take into account the number of stains v the number of people on a database.

Researchers realise there are limitations to the data. The usual approach is to present it and then challenge it.

How can ethics be made part of the laboratory process not something before or after?

Most scientists do consider ethics (even if it is subconsciously) as part of their objectivity and neutrality. One suggestion is ethical oversight for each laboratory. Peer review does happen in the labs.

Session II

DNA tests as an arbiter of truth - the case of family reunification (Ursula Naue, University of Vienna)

Family reunification refers to the right of foreign family members living abroad to join relatives who hold long-term residence permits or are citizens of a given country. This is an integral part of many country's immigration policies.

In use since the 1990s, DNA tests have been applied in the context of family reunification as a proof of family/biological relatedness, to narrow down the group of persons eligible for family reunification (excluding i.a. adopted relatives, social family and same-sex parents) and as a biological criterion for being granted citizen right.

Regarding interviews with case officers and identity papers, DNA tests in the context of family reunification are used as a tool for testing trustworthiness in the context of institutionalised mistrust. Between the official and the reuniting person, DNA tests work as an arbiter of truth, supposed to convince the official of what the reuniting person believes confidently to be true. In this context, different interpretations of the role of DNA tests exist – the the reuniting person's focus on an additional option to convince the case officer, and the case officer's focus on fraud. This focus on contradictions, lies and inconsistencies transforms the DNA test into a 'lie dectector'.

The Impact of Massive Parallel Sequencing on National Databases: Considerations, Challenges and Opportunities (Kees van der Beek, Netherlands Forensic Institute; Custodian Dutch DNA-database)

Kees van der Beek introduced the main objectives of his talk: development of forensic DNA database, storage and comparison of DNA profiles, allele differentiation by MPS and consequences for DNA databases, the differtiation of identical twins and

Mitochondrial DNA sequencing.

The development of national DNA databases is driven by technology (e.g. RFLPs to PCR multiplex) and standardisation (e.g. ESS). We have reached a point where national DNA databases are becoming very large.

According to the last estimates the Chinese database, the largest in the world, has over 20 million profiles. Over 15 million of DNA profiles are stored in the DNA database of the USA and over 5, 3 and 1 million in the UK, French and German DNA databases, respectively.

DNA profiles are currently stored and compared based on the STR alleles at a particular locus using the CE-based detection STR profiling system (length of fragments). Most countries use the CODIS format, which only allows four figures per allele name e.g. 31.2 = 4 figures.

The novel Massive Parallel Sequencing (MPS) technology allows genetically different alleles (based on their content) to be distinguished from alleles which appear to be the same using CE-based STR data. This will lead to reduced Random Match Probability and increased evidential value of DNA profiles. An example of allele differentiation (allele number 30) was presented along with related allele frequency estimates for different allele content (Rockenbauer E et al. Forensic Sci, Int. Genet. (2014) 8: 68-72). Mixed DNA results will also become easier to analyse.

The differentiation of alleles based on their content requires a new STR nomenclature to be developed in order to incorporate the additional variation and compare with existing DNA profiles -> guidelines Parson W et al. Forensic Sci. Int. Genet. (2016) 22: 54-63.

The research group lead by Peter de Knijff (Leiden University, the Netherlands) has suggested a new nomenclature format.. National DNA databases will have to be modified accordingly. The following criteria would be included:

- Locus name and CE STR allele name
- Chromosome and human genome assembly number
- STR repeat region co-ordinates of reference allele
- Full designation of STR motif
- Location of flanking region SNPs

This is a lot of data, but it seems to be a logical approach.

In addition, there are limitations to the current capillary electrophoresis technology, for example in differentiating identical twins. MPS could resolve such an issue, but it would involve Whole Genome Sequencing (WGS). This could lead to incidental findings such as health related information (e.g. somatic mutations unique to one of the twins). In this regard, future software may be able to be instructed to only report differences.

At present, for mitochondrial DNA, only part of the genome is sequenced, but MPS technology increases the power of discrimination and hence evidential value. However, mtDNA could also reveal diseases causing mutations. Also in this case the software can be instructed to ignore known mutation sites.

Discussion/ Questions

Is ambiguity in the DNA results or family relationship grounds for appeal?

In Austria, no.

Experience in Germany indicates that it is a very rare occurrence that the DNA results do not support the claimed relationship. Therefore it could be seen as unnecessary. In Germany it is possible to accept social family members in extenuating circumstances. It's not possible to test that 2 people are not related with DNA.

Where are the DNA samples taken?

At the embassy.

If MPS reduces the number of false matches and false inclusions **do you think there will be a lot of requests for re-testing? Is there information available about false exclusions?**

The chances of false exclusions as well as mistakes of that kind are low.

Is there informed consent for family members giving DNA samples for reunification purposes, could their data be used for research purposes?

It shouldn't but it could happen.

<u>Session III</u>

From forensic genetics to genomics- Perspectives for an integrated approach to the use of genetic evidence in Criminal Investigations (Prof. Peter Schneider, University of Cologne)

We are currently witnessing a shift from forensic genetics to genomics. We start the process at the crime scene but where do we stop? An increase in sensitivity has already changed the starting material we can get a DNA profile from, from a body fluid to a single cell. The aim is always a single source DNA profile.

Over 20 years of STR typing, there has been a huge increase in European DNA databases

but there are still unsolved crime profiles (1.6 million in Germany).

Capillary electrophoresis is established, reliable, standardised and, perhaps most importantly, accepted! The cost-benefit ratio is seen to be favourable. However, there are challenges with certain DNA samples, mixtures, kinship testing, distant relationships and some technical restrictions.

Body fluid identification is now possible via RNA testing. We have moved beyond identification to obtaining extra information (e.g. biogeographic ancestry) and even predicting externally visible characteristics (EVCs). Next generation sequencing allows for the analysis of identity SNPs (single nucleotide polymorphisms), lineage SNPs and forensic DNA phenotyping e.g. face morphology. DNA methylation studies may provide information about the age of a donor.

The Parabon DNASnapshot service raises certain issues around this technology and what is acceptable. Producing stereotypes rather than phenotypes!

So while MPS data may provide new intelligence leads, there may be sensitive personal data as well. How can these massive amounts of data be secured and filtered? The limitations of the technology still remain to be fully explored and defined.

Genetics + Technology = Security + Justice (Dr. Carole McCartney, Northumbria University)

Dr. McCartney has recently moved back into the field of forensic genetics and offered us an overview of the criminal justice system as it stands in relation to DNA. She began her presentation by reminding us of the importance of precision of language and terminology and then asked what should the forensic process look like?

There are policing demands, court demands, analytical processes, databasing and research & development to take into consideration, along with the filters of ethics and regulations. Forensic capabilities often drive operational policing and ultimately prosecutions. Where do the ideals of security and justice come from, are they related to prosecutions? The law is actually very bad at regulating things as it can be interpreted and applied in so many different ways.

In reality, operational policing often ends up driving the forensic science strategy. Does intelligence translate into proactivity? Prosecution is a small aspect of justice, not many criminals get prosecuted compared to the large number of crime stains on a database. Maybe the market is driving things?

What about human rights? Humanitarian does not necessarily mean ethical.

Cross-border data sharing; are we really collaborating or just dumping data on each

other?! Is DNA technology really global? It brings up questions of geopolitics. We may assume that we are all sharing the benefits but this may not be the case.

Claims need to be justified- show your workings! Are cost-benefits really being examined? Also, there is a need to focus on the pre- and post-laboratory processes.

Discussion/ Questions

DNASnapshot has not been accepted in the Netherlands.

Maybe MPS could actually work out cheaper than CE. Costs are decreasing. There may be a period of parallel nature to DNA databases. Novel technology is always expensive at the beginning. There is a real need for standard nomenclature and integration of current and new technologies.

This idea of ethics, the law and governance being external to scientists practice is worth exploring/ challenging. They need to be integrated throughout the process.

When you say show your workings, what do you mean? How much do you want to see?

All claims need to be justified; whether they are the goals of Prüm or post-analysis. Need to think about articulating benefits. Transparency. What happens after a DNA match is reported?

Maybe justice is happening day to day in the laboratories; when someone decides to carry out a test or not. This is positive. Also the use of DNA to exonerate a main suspect is very positive but there is little data on this.