National DNA Databases and some other deliberations

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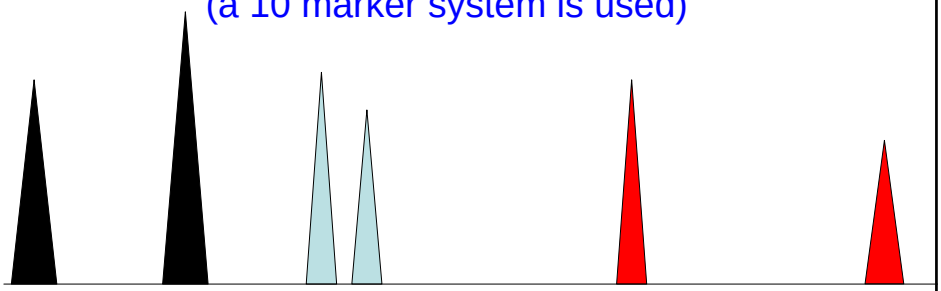
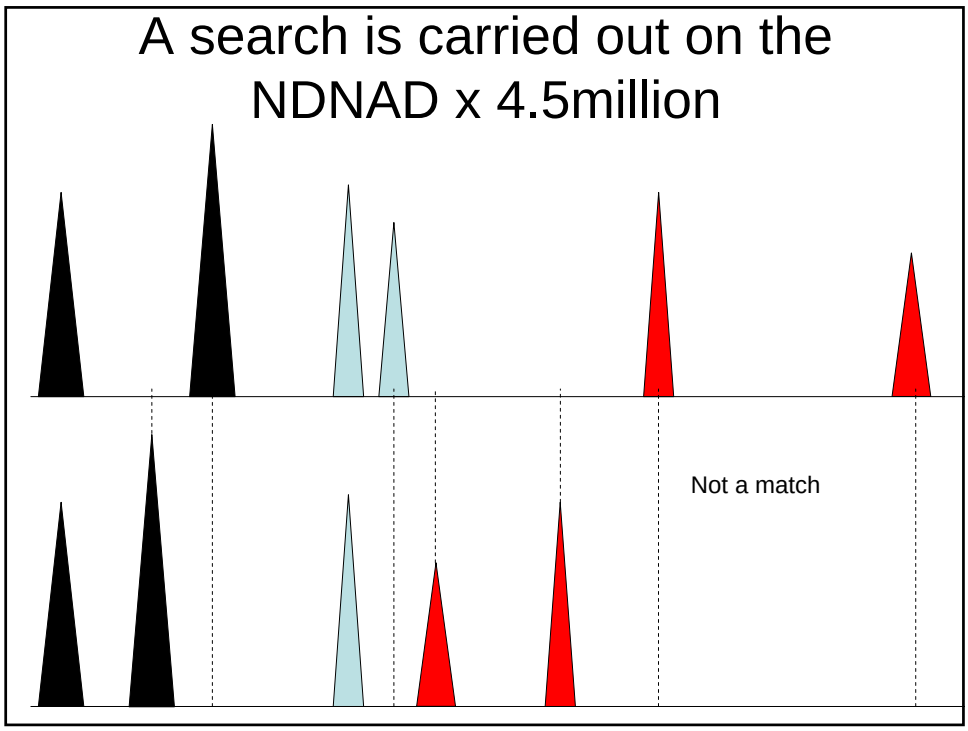
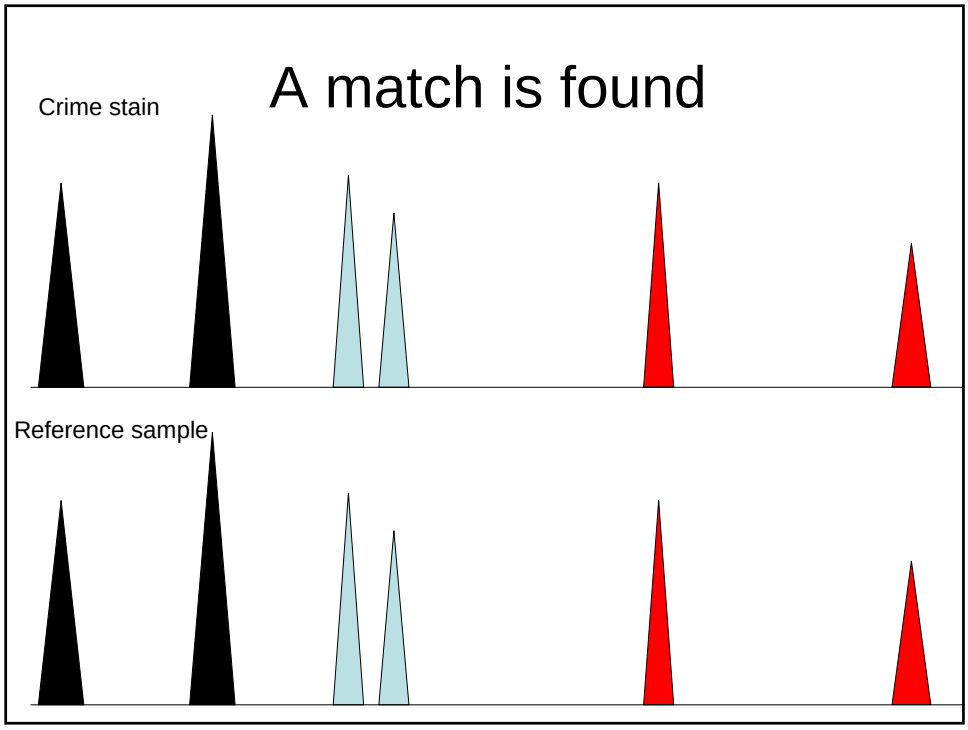
(note –views expressed are not endorsed by any organisation unless otherwise stated)

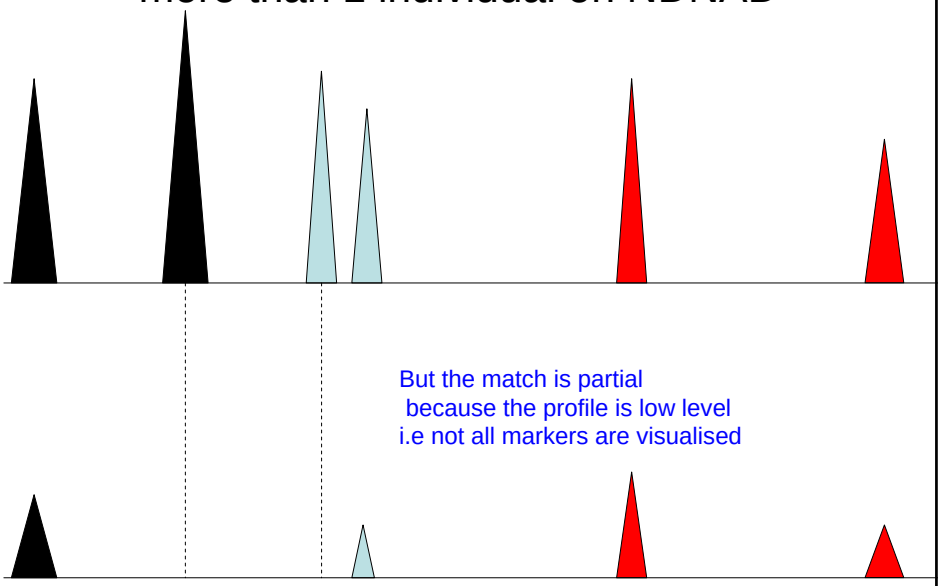
A crime stain is analysed and a profile is obtained (a 10 marker system is used)




A search is carried out on the NDNAD x 4.5million
Not a match


A match is found
Crime stain
Reference sample

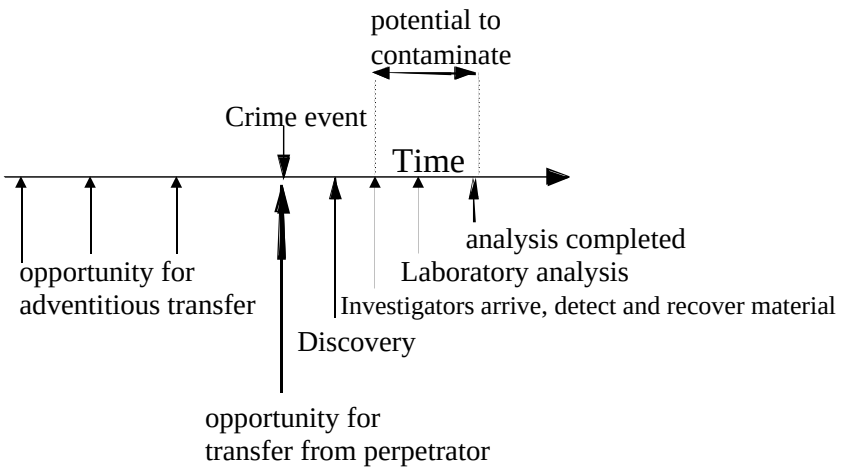
A low level (or partial) profile- may match more than 1 individual on NDNAD



The strength of the evidence is determined

- The statistic depends on the number of matching markers – on a scale from 1 in 10 to 1 in 1 billion+
- If there is a mis-match or there are missing markers then special considerations apply
- These are typical of low level profiles and mixtures
- But is the DNA evidence relevant?

A time line – published in 2001



Meaning of a match

- The fact of a matching DNA profile with a suspect is one piece of information
- How the profile became evidential is a separate consideration
- Uncertainty of the latter does not invalidate the former
- *Relevance of evidence* seems to be the main point in the Omagh trial
- Low-level DNA was developed as a *philosophy* and not a method *(speaking as the 'inventor')*
- *Low-level DNA characteristics are found in all DNA methods*
- *Note that some Omagh profiles were not low-level*

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www.elsevier.com/locate/fsig

Letter to the Editor

National recommendations of the Technical UK DNA working group on mixture interpretation for the NDNAD and for court going purposes

- *"We do not consider the LCN label for 34 cycles work to be useful, or particularly helpful, and propose to abandon it as a scientific concept, because a clear definition cannot be formulated. Rather, our aim is to recommend generic guidelines that can be universally applied to all DNA profiles that are independent of the method utilised."*

Meaning of a match *(Omagh lessons)*

- CPS position is that DNA evidence cannot be used without supporting non-DNA evidence
- PPS position is that DNA evidence can be used without supporting non-DNA evidence
- It is *not* for the scientist to decide whether/ or not a prosecution should proceed.
- It is naïve to believe that a *failure to convict* is somehow associated with a *failure of science* –the purpose of the scientist is to assist the court in the *meaning* of the evidence (in the context of the whole case) in a *neutral way* preferably *without duress*.
- Each case needs to be considered on its specific merits.
- Presence of a profile does not mean guilt.
- It is irrelevant whether the scientist is called by the *prosecution* or by the *defence.*
- However there is a serious need to educate and to make courts more *user friendly* to facilitate discussion and debate.
- Limitations of the adversarial system for complex scientific issues to consider

UK role as the world leader?

- Some-one has to be first! – Rest of the world *does still* look to the UK for leadership.
- Generally takes up to 5-10 years for a technique to be adopted by other jurisdictions – 20th anniversary of DNA profiling this year.

Integration into the Prum treaty

- On 27 May 2005 the Prum Treaty was signed by Germany, Spain, France, Luxembourg, Netherlands, Austria and Belgium.
- Covers a series of justice and home affairs issues including the "exchange of information" (in effect, the "principle of availability").
- Since 2005, many others have agreed in principle to join Prum treaty.

Finite life for existing system?

- Now on the third iteration of the *multiplex*
- First iteration – 1 in 10,000 1990
- Second iteration – 1 in 50,000,000 1995
- Third iteration – 1 in 1,000,000,000,000 2000
- Is this enough?
- Change mainly driven by high rate of false inclusion
- But the science has moved on considerably over the last 5 years - there is a big danger that we lock into out-dated technology because of inertia (our biggest challenge)

EC funded 'database exchange ENFSI project'

- Purpose is to facilitate exchange of data throughout Europe
- To carry out predictive analyses and to advise EU policy makers
- A multiplex has a life span of about five-ten years
- How do we manage continuous change?

How efficient is the NDNAD?

A discussion on the ‘error’ rates

- Analogy
  - A hospital tests patients for cancer
  - Sometimes the test gives a false positive
  - Sometimes the test gives a false negative
  - Which is the more serious?
  - *Both are undesirable but only one is life-threatening*

Errors and the NDNAD

- A false inclusion is a crime profile that matches a random person who is innocent
- A false exclusion is a crime profile that fails to match a perpetrator who is actually on the database
  - Which is the most serious?
  - *Experiments and monitoring have limitations because the sample sizes are so small and errors may be hidden. e.g. we may be concerned by the 1 in 1 million event.*

How long will the NDNAD be viable in its present iteration?

UK DNA database SGM plus

year	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	
no on database	2765000	3265000	3765000	4265000	4765000	5265000	57
number of case stains	584000	634000	684000	734000	784000	834000	8
number of pairwise comparisons	1.615E+12	2.07E+12	2.58E+12	3.13E+12	3.74E+12	4.39E+12	5.
Probability of SGMplus random match (from simulation)	1.12E-12	1.12E-12	1.12E-12	1.12E-12	1.12E-12	1.12E-12	1.1
(Np=lambda) mean no of adventitious matches expected	2	2	3	4	4	5	
Probability of >=1 adventitious match	0.540	0.673	0.783	0.865	0.921	0.957	0
Probability of >=5 adventitious matches	0.011	0.031	0.073	0.143	0.244	0.369	0
Probability of >=10 adventitious matches	0.000	0.000	0.000	0.001	0.004	0.012	0

This means that a very small number of adventitious matches may already be expected even with a multiplex where the $Pm=10^{-12}$

It is possible to predict the performance of a database in relation to the projected size of the database and the number of comparisons expected/

Suppose we want to include whole of UK?

- Population size = 60 million
- Anticipate 1 million case stains by 2012
- Existing system is not powerful enough

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Short communication

The evolution of DNA databases—Recommendations for new European STR loci

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This paper details ENFSI agreed recommendations for 5 new markers to be introduced into new generation multiplexes.

Addressing false inclusions – what are the problems to introduce a new multiplex?

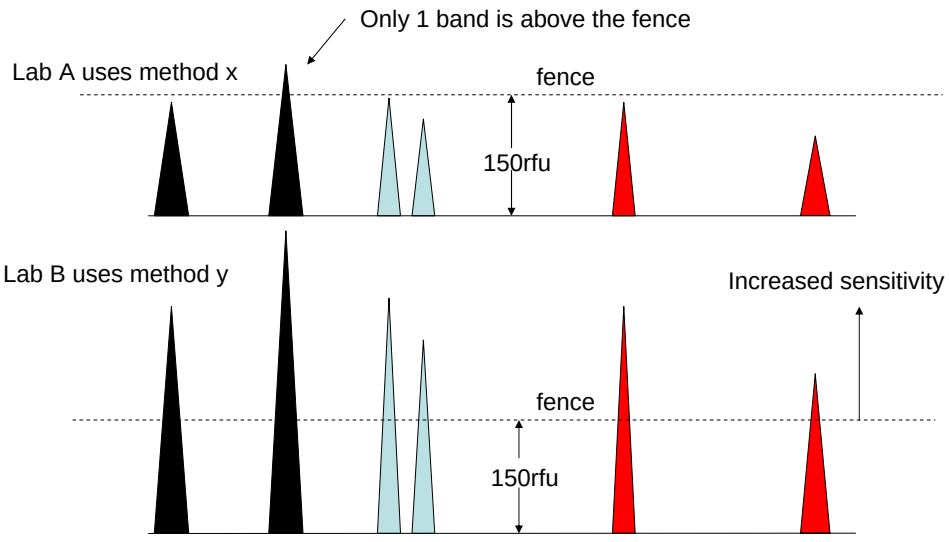
- Currently 7 European standard loci – low discrimination
  - This is because Europe is unfortunately not standardised on a single multiplex
- Need to increase by at least 3 and preferably by 5 new markers (‘*select committee recommendation’*)
- BUT will new multiplex systems actually be built??
- We are solely dependant upon commercial companies as the provider.
- Will companies invest when there is no guarantee of making a return?
- Why should a company with a monopoly invest?
- New multiplexes will be more expensive!
- Who will pay?
- Patents are preventing competition and encourage monopolies.
- Policies need to be converted into practical applications – this requires coordination at several levels. There are scientific, commercial and socio-political issues to consider.

What about false exclusions?
More difficult to evaluate

- Definition: where a suspect *is* on the NDNAD but fails to match a case sample
- More serious than a false positive – noting that the database is an *intelligence* database.
- Is this possible?
- Yes – we need to continually improve the robustness of our systems.
- We need to design systems according to agreed criteria – what is the acceptable error rate?
- This is definitely not one for the scientist

Laboratories compete to produce the most sensitive method – but the NDNAD uses a fence that is static!

A fence that is too low increases the chance of the chance of a false exclusion



Some points for debate

•Courts require uniformity of process (keep scientific debate out of court)
•All labs need to provide similar answers to courts (given the profile)
•A demonstration is needed that a given method is widely used and accepted by the forensic community
•How can this be achieved within the context of the *commercial ethos* where patents and trade secrets are important?
•Continuing education is a requirement – again *standardisation of interpretation and other methodology* is key.
•Is it desirable to know error rates of the NDNAD?
•What are the accepted levels given that the error rate cannot be zero
•How do we coordinate development of the NDNAD to the next stage across commercial suppliers?