Development in forensic science research – looking to the future

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Content

- What do we understand by 'research' ?
- The current state of play in forensic science research
- New technology
- Research needs and challenges
- Future research directions

What do we understand by 'research' ?

Oxford English Dictionary

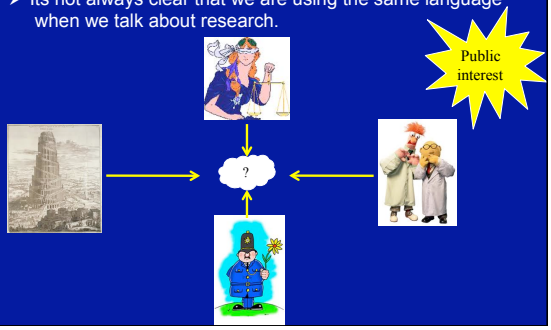
RESEARCH:

" the systematic investigation into, and study of, materials and sources in order to establish facts and reach new conclusions"

late 16th century French: re-(expressing intensive force) + cerchier 'to search'

What do we understand by 'research' ?

- Its not always clear that we are using the same language when we talk about research.



What do we understand by 'research' ?

- What are the objectives ?
- This can help define the approach and methodology

Management tool
Evidential use
Effectiveness
?
Intelligence use
Service evaluation
Customer satisfaction

RESEARCH	SERVICE EVALUATION*	CLINICAL AUDIT	SURVEILLANCE	USUAL PRACTICE (in public health)
The attempt to derive generalizable new knowledge including studies that aim to generate hypotheses as well as studies that aim to test them.	Designed and conducted solely to define or judge current care.	Designed and conducted to produce information to inform delivery of best care.	Designed to manage outbreak and help the public by identifying and understanding risks associated.	Designed to investigate outbreak or incident to help in disease control and prevention.
Quantitative research – designed to test a hypothesis. Qualitative research – identifies/explores themes following established methodology.	Designed to answer: "What standard does this service achieve?"	Designed to answer: "Does this service reach a predetermined standard?"	Designed to answer: "What is the cause of this outbreak?"	Designed to answer: "What is the cause of this outbreak?" and treat.
Addresses clearly defined questions, aims and objectives.	Measures current service without reference to a standard.	Measures against a standard.	Systematic, statistical methods to allow timely public health action.	Systematic, statistical methods may be used.
Quantitative research – may involve evaluating or comparing interventions, particularly new ones. Qualitative research – usually involves studying how interventions and relationships are experienced.	Involves an intervention in use only. The choice of treatment is that of the clinician and patient according to guidance, professional standards and/or patient preference.	Involves an intervention in use only. The choice of treatment is that of the clinician and patient according to guidance, professional standards and/or patient preference.	May involve collecting personal data and samples with the intent to manage the incident.	Any choice of treatment is based on clinical best evidence or professional consensus.
Usually involves collecting data that are additional to those for routine care but may include data collected routinely. May involve treatments, samples or investigations additional to routine care.	Usually involves analysis of existing data but may include administration of interview or questionnaire.	Usually involves analysis of existing data but may include administration of simple interview or questionnaire.	May involve analysis of existing data or administration of interview or questionnaire to those exposed.	May involve administration of interview or questionnaire to those exposed.
Quantitative research – study design may involve allocating patients to intervention groups. Qualitative research – uses a clearly defined sampling framework underpinned by conceptual or theoretical justifications.	No allocation to intervention: the health professional and patient have chosen intervention before service evaluation.	No allocation to intervention: the health professional and patient have chosen intervention before audit.	Does not involve an intervention.	May involve allocation to control group to assess risk and identify source of incident but treatment unaffected.
May involve randomisation.	No randomisation.	No randomisation.	No randomisation.	May involve randomisation but not for treatment.

NRES guidance – defining research

Current forensic science research

so…..

……there are a variety of perspectives on what ‘research’ is

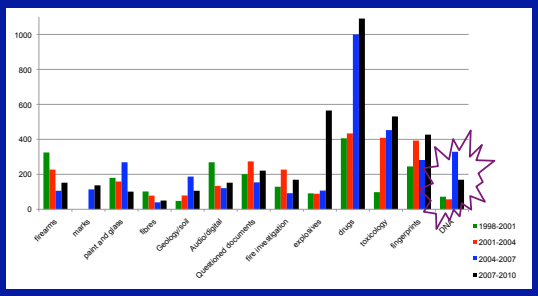
- Complex, ill defined and ‘messy’ research environment
- Multiple levels (short term, long term etc)
- Often reactive and has tended to be either technology or ‘case’ driven

What do we understand by ‘research’ ?

Methodical, Organised, Controlled, Iterative, Planned, Evaluated, Interpretative

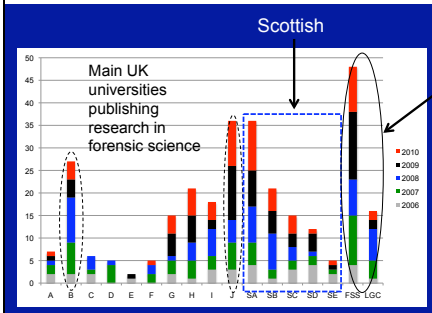
Now … What was your question ?

Current forensic science research



Interpol forensic science symposium papers

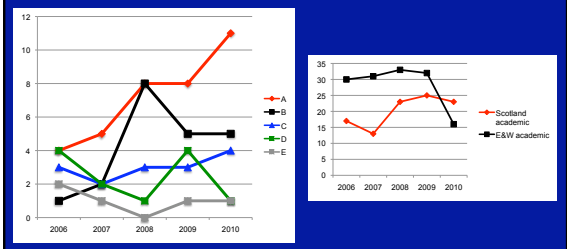
Current forensic science research



Web of science : forensic + specific academic institutions, corrected for forensic medicine

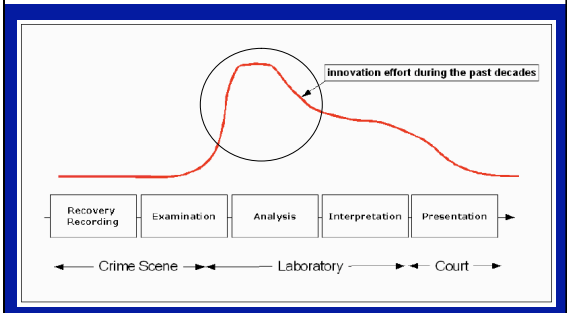
Current forensic science research

Scotland – research output in forensic science



Web of science : forensic + specific academic institutions

Current forensic science research



ENFSI position paper on R&D 2009

New technology

Research can generate new technological advances.

However, most forensic science research involves the use of existing technology.

Technology can run ahead of research which introduces an element of risk that needs to be managed.

We don't need new technology to conduct meaningful high quality research.

New technology

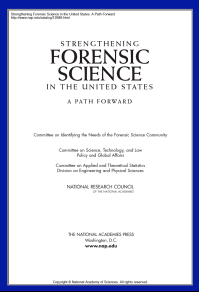
Tendency to move to deliver results of evidential value prior to the development of the underpinning research.

Research needs and challenges

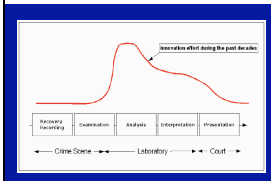
" The simple reality is that the interpretation of forensic evidence is not always based on scientific studies to determine its validity.

This is a serious problem.

Although research has been done in some disciplines, there is a notable dearth of peer-reviewed, published studies establishing the scientific basis and validity of many forensic methods. "



Research needs and challenges

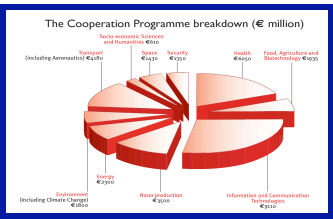


ENFSI perspective

Research priority areas:

- Crime scene recovery and recording – digital technologies
- Objective interpretation including multi-modal evidence
- Mobile technologies (lab on a chip, nanotechnologies etc)
- Presentation of evidence to end users

Research needs and challenges



EUROPEAN SECURITY RESEARCH & INNOVATION FORUM
ESRIF

- Systematic needs : Interpretation / Reporting / Logical Reasoning / Accreditation Frameworks / Standards / Best Practices / Error Rates/
- Research needs : Technology for interpretation / Logical and Correct Reasoning/ Trace recovery, Crime scene recording and reconstruction / databases / international standards

Research needs and challenges

- Growing awareness and consensus of the research gaps
  - Linking researchers, funders and political support is challenging but there is a strong desire to do this.
  - Requires effective communication and cooperation.
  - Development of a forensic science research framework would probably be useful.

Research needs and challenges

The courts are already beginning to make statements in terms of what is needed…

For example *experience v scientific research*

R v Weller [2010]
R v Reed and Reed [2009]

Research needs and challenges

" *…if one tries to question science purely by reference to published papers and without the practical day-to-day experience upon which others have reached a judgment, that attack is likely to fail ……*

…. (hoped) *the courts will not be troubled* ….*by attempts to rely on published work by people who have no practical experience in the field and therefore cannot contradict or bring any useful evidence to bear on issues that are not always contained in scientific journals."*

Lord Justice Thomas in R v Weller [Appeal Court; 2010]

Research needs and challenges

Experience matters…… but it needs validation by appropriate research and empirical measurement

Relying *only* on experience is potentially dangerous

Applying the results of empirical measurement *without* context is also dangerous

Research needs and challenges

Hierarchy of propositions :

Offence

Activity

Source

The interpretation challenge

$$LR = \frac{\text{Probability of forensic findings if prosecution proposition } (H_p) \text{ is true}}{\text{Probability of forensic findings if defence proposition } (H_d) \text{ is true}}$$

Research needs and challenges

Fit forensic science research into the existing framework

Balanced

logical

Robust

Transparent

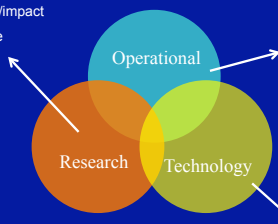
For example there is little published research on :

Transfer
Persistence
Recovery
Background contamination

Standards for the formulation of evaluative forensic science expert opinion, AFSP S&J : 49,3,161-164

Looking to the future

Database development : well defined and ill defined data
Interpretation : activity level, evidential value, context / bias
Effectiveness/impact
Novel science



Timeliness
Best practice
Effectiveness

Adoption : eg DNA profiling, micro FTIR, Raman, IRMS
Extension : lab on a chip, nanotechnology, STR
Creation : stand-off detection, bio-imaging, digital

Adapted from C Roux

Research needs and challenges

Funding and resourcing

Average PhD project costs *circa* £75,000

Little or no direct research funding available for forensic science from research councils

Some funding available through specialist sources

Funding is very competitive and forensic science research does not compete well against other sciences.

Research needs and challenges

- End user and stakeholder partnerships are essential
- A measure of impact of research is critical

Quality

Efficiencies

Impact

Societal

Cost/benefit

Working towards the future together

Working together in partnership

Talking a common language

Developing a shared research agenda and framework

Focused, realistic, and achievable outcomes

Developing funding models

Thank you !

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