FORENSIC SCIENCE BASICS

Rebecca Brackman, May 25, 2017
What is forensic science and evidence?

- Forensic science just means use of scientific evidence in the courtroom
- Traditional types of forensic science and evidence
  - Fingerprints
  - FATM v. ballistics v. GSR
  - Pathology
  - SART
  - DNA
  - Arson
  - Dog scent
  - Etc.
In what kinds of cases will you have forensic evidence?

Used to be:
- Murders
- Sexual assaults
- Serious felonies

Now:
- Car burgl with DNA
- DV with injury opinions
- Trash fires with arson experts
Why you shouldn’t be intimidated:

You are NOT dealing with:
Closer to who you are dealing with:
WHY YOU NEED TO CARE ABOUT HOW TO CHALLENGE

- **You will be IAC!**
  See *Hinton v. Alabama* (2014) 134 U. S. 1081, NOT sufficient to just hire any expert and leave it at that. Need to get correct expert, need to know enough to get correct expert, need to push for funding.

- **You can win!**
  Let’s give you some help with figuring out how to do that.
Basics of what you need to know

- Some of it is utter junk
- All of it can be overstated or distorted
- Get full discovery-this makes critical difference
- Make book on their experts
- It can actually help you if you fully understand the results
Examples of mistakes in forensics:

- Contamination
- Not running controls
- Dry labbing
- Misinterpretation of results / bias
- Coincidental matches
- Mislabeling of samples or results
- Substitution of results from other cases
- Lying about qualifications
- Planting of evidence
Increased high profile examples of mistakes
“With the exception of nuclear DNA analysis, no forensic method has been rigorously shown able to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.”
Research is needed to address issues of accuracy, reliability, and validity in the forensic science disciplines. (NAS p. 190)
Are there additional steps on the scientific side, post-2009 NAS Report, that could help ensure the validity of forensic evidence used in the Nation’s legal system?
What is the PCAST Report?

- PCAST did a year-long study
- Compiled and reviewed a set of more than 2,000 papers from various sources
- Educated itself on factual matters relating to the interaction between science and the law
- Obtained input from forensic scientists and practitioners, judges, prosecutors, defense attorneys, academic researchers, criminal-justice-reform advocates, and representatives of Federal agencies.
- Made recommendations directed at the National Institutes of Standards and Technology (NIST), the White House Office of Science and Technology Policy (OSTP), the Federal Bureau of Investigation (FBI) Laboratory, the Attorney General, and the judiciary
Findings regarding scientific validity

The basics:

- Only single source samples of DNA and fingerprints are scientifically validated.
- Firearms has one study establishing its validity (need 2!)
- Bitemark, shoeprint, hair comparison, interpretation of mixtures of DNA – not validated, some even are invalid.
PCAST Recommendation 7:

Where there is no meaningful information about the accuracy of a forensic feature-comparison method, US DOJ attorneys and examiners should not offer testimony based on the method.

In testimony, examiners should always state clearly that errors can and do occur, due to similarities in features and due to human mistakes in the lab.
Thanks, but no thanks.
US DOJ Response

- Attorney General Loretta Lynch said in a statement to The Wall Street Journal, “While we appreciate their contribution to the field of scientific inquiry, the department will not be adopting the recommendations related to the admissibility of forensic science evidence.”

- Under Lynch, the DOJ did require federal prosecutors to use only accredited labs by 2020, and directed federal crime labs to eliminate the term “reasonable scientific certainty.”
And then Jeff Sessions happened.

**The Scientist**

**Forensics Left in Lunch by Sessions**

US Attorney General Jeff Sessions is terminating a commission in which independent researchers and federal agencies seek to improve forensic science standards.

By Bob Grant | April 11, 2017

The forensic science community is reeling after this week’s announcement that US Attorney General Jeff Sessions will shutter a commission designed to improve the conduct, application, and presentation of forensic science and evidence in the US Justice system. Sessions said in a statement released on Monday (April 10) that he was allowing the National Commission on Forensic Science (NCFS), which was...
And we are talking about evidence actually being used to execute people...

FBI review revealed that 26 of 28 examiners testifying on hair and fiber gave erroneous testimony, including in 32 death penalty cases. 14 of those have been executed or died in prison...
The Brandon Mayfield Error

- Office of the Inspector General - 2 reports
Contributing Causes

- Bias from the known print:
  - “Backward” or “circular” reasoning
- Non-blind verification
  - “…the initial examiner was a highly respected supervisor with many years of experience, … To disagree was not an expected response.” (FBI)
- Mayfield’s Religion, etc.?
  - Overconfidence ➔ Confirmation Bias
Cognitive Bias

- Broad term, many different specific biases
- Not an ethical issue
- Universal, automatic, without awareness
- Cannot be overcome by force of will or good intentions
- Investigation and forensic analysis:
  - Confirmation bias
  - Context effects (Observer bias, Expectancy effects)
Confirmation Bias

- Once a hypothesis is formed...
  - Seek out/notice/overvalue confirming evidence
  - Avoid/ignore/undervalue disconfirming evid.
  - Blindness to alternative scenarios, tunnel vision

- Criminal investigations:
  - Have a suspect → figuring out what happened
  - Approach the task as if the suspect is guilty

- Analysts:
  - Implicit message when evidence submitted
Context Effects

The effects of context [and expectations, emotions, motivation, prior knowledge] on perception and decision-making.
Strengths:

- Actual latent print examiners
- Covert testing – normal routine
- Results reflect real world, casework

Preliminary communication

Contextual information renders experts vulnerable to making erroneous identifications (2006)

Itil E. Dror *, David Charlton, Ailsa E. Péron
“Contextual Information…” study

- 5 Latent Print Examiners, average 17 yrs experience
- Past case prints previously judged by the examiner to match Madrid/Mayfield prints suggests ≠
“[Prosecutor] left msg. stating this S. is suspected in other rapes but they can’t find the V. Need this case to put S away.”

“So, I said, you basically have nothing to connect him directly with the murder (unless we find his DNA). He said yes.”

“Death penalty case! Need to eliminate Item #57 [name of individual] as a possible suspect”
“If this was several baggies of green plant material it would obviously be repetitive to test them all. However, this case is more analogous to a latent fingerprint. There are a certain number of points of comparison needed before the examiner feels comfortable declaring a match.

In a case such as this, the DA is the examiner and in order to feel comfortable declaring that a citizen is guilty of murdering a human being and attempting to imprison that person for life, I need another point of comparison.”
Example of embracing the results...

Bench notes show only 3 nanograms of human DNA, way too little to be from contact with her vagina, instead is from touch or transfer from her person.
Screening / Serology
The retention and transfer of spermatozoa in clothing by machine washing

E. Kafarowski, A.M. Lyon and M.M. Sloan

Abstract

The interpretation of trace findings on spermatozoa on clothing is often problematic, as the manner of deposition may not be readily determined. Particularly troublesome are cases involving complainants who are unable to relate a complete history. Small numbers of spermatozoa may be a result of some type of sexual activity or may be due to an unrelated, innocuous incident. Transfer of spermatozoa between items during machine washing has been theorized as one possible method of indirect deposition. This research was undertaken to determine the likelihood of such a transfer. A normal machine wash was simulated in three independent experiments. Pristine items of clothing were washed together with one of semen-stained panties. After washing, random samples (N=162) from nine unstained items were examined microscopically. Some spermatozoa were detected on all nine previously pristine items included in the wash loads. Three to eight spermatozoa were identified in 6% of the samples. One or two spermatozoa were identified in a further 38% of the samples. The original semen-stained panties were also examined following washing. Although there was no visible staining or acid phosphatase activity, significant numbers of spermatozoa were retained in the original stains at 38% of the samples. The analysis and interpretation of these findings is discussed with reference to current DNA methods.

Technical note: could secondary DNA transfer falsely place someone at the scene of a crime?*†

Cynthia M. Cale, Madison E. Earl, Krista E. Latham, and Gay L. Bush

Abstract: The occurrence of secondary DNA transfer has been previously established. However, the transfer of DNA through an intermediary has not been explored with more sensitive current technologies implemented to increase the likelihood of obtaining results from low-template/low-quality samples. This study evaluated whether this increased sensitivity could lead to the detection of uninterpretable secondary DNA transfer profiles. After two minutes of hand contact, participants immediately handled assigned knives. Swabs of the knives with detectable amounts of DNA were amplified with the Identifiler® Plus Amplification Kit and ingested on the 3130xl DNA typing results indicated that secondary DNA was elevated in 85% of the samples. In five samples, the secondary contributor was either the only contributor or the major contributor identified despite never coming into direct contact with the knife. This study demonstrates the risk of assuming that DNA recovered from an object resulted from direct contact.

Keywords: Forensic science, criminology, DNA analysis, secondary transfer, forensic casework, Identifiler® Plus 
DNA Transfer – how it works

Source → Vector → Evidentiary Item

Primary Transfer → Secondary Transfer
South Bay Paramedics Likely Brought Innocent Man's DNA To Murder Scene

June 28, 2013 12:41 AM

Ravesh Kuma was killed during a home invasion robbery in his Monte Sereno home on November 30, 2012. (CBS)
DNA Transfer – Monte Serrano case

Source → Vector → Evidentiary Item

Primary Transfer:
- Defendant in hospital
- Paramedics provide care to him
- Utilize same equipment and clothing
- To decedent, DNA found under his fingernails
Resources / things you MUST do to prepare

- Review protocols
- Research articles
- Transcripts
- Meet with the prosecution expert
- Motions to exclude
- Motions to limit the opinion
- Get appropriate defense expert
HELPFUL RESOURCES
Thank You!