# Reducing Error Rates:
## A New Institutional Arrangement for Forensic Science

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# Summary

- Errors exist
- Familiar solutions would help
- We need structural redundancy too

  Keeping a spare tire in the trunk

  My contribution
- Redundancy saves money

  The cost of incarcerating a wrongly convicted felon is 1,000 greater than the cost of a fingerprint exam.
- We have an organizational design problem

  How do we build redundancy into the system?
- Implement some forms of redundancy right away
- Study more comprehensive programs of redundancy

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# Error exist

- Limits of science and evidence
- Honest mistakes
- Carelessness
- Incompetence
- Unconscious bias
- Conscious bias
- Fraud

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# What to do?

- Better selection and training of forensic scientists
- Improved scientific foundations
- Independence
- Masking
- Oversight
- Other
  - Evidence lineups, blind proficiency tests, accreditation . . .
- "Competitive self regulation"

  Checks and balances

  Redundant examinations

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# Better selection and training of forensic scientists

- Dror & Charlton
  - "Why Experts Make Errors," *Journal of Forensic Identification*, 2006
  - "better selection" and "better training"
- NIJ Technical Working Group for Education and Training in Forensic Science (TWGED)
  - "Education and Training in Forensic Science: A Guide for Forensic Science Laboratories, Educational Institutions, and Students,"2004

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# Better selection and training of forensic scientists

- Valuable and necessary
- Not sufficient as illustrated by

  Brandon Mayfield misidentification

  Three highly trained, top FBI experts aligned in the error
- We need an organizational fix, too
  - Research science is reliable because of its organization
  - Structural redundancy
- A chain is only as strong as its weakest link

  A net is stronger than any of its knots

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# Improved scientific foundations

- More scientific research on forensic techniques
- DNA model
- Saks & Koehler
  - " The Coming Paradigm Shift in Forensic Identification Science," *Science*, 5 August 2005.

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# Improved scientific foundations

- Valuable and necessary
- Doesn’t address human element
  - Jacqueline Blake
  - Houston Crime Lab
  - Seattle crime lab
- That, again, is an organizational issue

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# Independence

- Crime labs should be independent of police and prosecution
  - Or defense for that matter
- Addresses organizational question
- Paul Giannelli
  - "The Abuse of Evidence in Criminal Cases: The Need for Independent Crime Laboratories," *Virginia Journal of Social Policy & the Law*, 1997

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# Independence

- Valuable and necessary
- Essential for “competitive self regulation”
- Not sufficient as illustrated by the example of Dr. Steven Hayne of Mississippi

  Performs 1500 autopsies per year

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# Masking

- Domain-irrelevant information should be hidden ("masked") from forensic examiner
- Reduces conscious and unconscious bias
- Michael Risinger et al.
  - "The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion," *California Law Review*, 2002

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# Masking

- Valuable and necessary
- Essential for “competitive self regulation”
- Not sufficient as illustrated by the example of Jacqueline Blake of the FBI lab DNA section
  Neglected to perform her negative tests
  Apparently for lack of self confidence
  She needed an independent epistemic check

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# Oversight

- A guardian body must watch over forensics to make sure things are done right
- Peter Neufeld
  - "The (Near) Irrelevance of Daubert to Criminal Justice and Some Suggestions for Reform," *American Journal of Public Health*, 2005

"Government oversight and the creation of independent academic centers to validate technologies and techniques, encourage best practices, and enforce appropriately cautious standards for the interpretation of data could dramatically enhance the reliability of forensic science and engender greater public confidence in the outcome"

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# Oversight

- Valuable and necessary
- But
- Who will guard the guardians themselves?
- Only a supplement to
  a well-designed system of checks and balances

# Which brings me to . . .

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# Competitive self regulation

- Checks and balances
- Gives each person the right incentives
- More importantly: creates epistemic checks
- Structural Redundancy

  *The* essential element in the organization of science

  The results any one lab may be challenged by any other lab

  Redundancy makes science reliable

  Redundancy makes science science

  and not alchemy

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# Redundancy

- If one forensic scientist has a random 10% chance of erring, 2 independent forensic scientists have only 1% chance of both erring
- Which is right?

  You need an “aggregation mechanism”

  voting
- Majority opinion of 3 independent forensic scientists will be wrong only 2.8% of the time.
- Redundancy *can* reduce error rates

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# Design matters

- ACE+V illustrates

  No independence

  No masking

  Some examiners shop their verifications

  Errors

    Donna Birks

    Brandon Mayfield

- Redundancy requires the right design

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# Competitive self regulation

- Eight features:
  Randomized redundancy
  Independence
  Statistical review
  Masking
  Forensic counsel for the indigent
  Division of labor
  Vouchers
  Privatization

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# Randomized redundancy

- A jurisdiction should contain several competing forensic labs
- Random assignment of evidence to system labs
- Some evidence should be chosen at random for multiple testing at other labs
- Double randomization

  Assignment of cases

  Selection of evidence for redundant examination

    Not all evidence can or should be subject to multiple examination

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# Independence

- Crime labs should be independent of police and prosecution
  - Or defense for that matter
- Reduces bias
  - Conscious
  - Unconscious

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# Statistical review

- Because redundancy is (doubly) randomized, all labs in the jurisdiction should have a similar statistical profile
- Statistical review is possible
  - For example, if a given lab produces an anomalously large number of inconclusive findings, its procedures and practices should be examined by an officer of the court
- Quality control

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# Masking

- Forensic scientists should be shielded from domain-irrelevant information when conducting forensic analyses
- Knowing the case at hand is a murder, not a burglary, exposes a fingerprint examiner to a powerful unconscious bias.

# Forensic counsel for the indigent

- Just as an indigent defendant has a right to the help of a qualified attorney, an indigent defendant should have the right to the help of a qualified forensic scientist
- Title 18 of US Code
  - Representation under each plan shall include counsel and investigative, expert, and other services necessary for adequate representation.
- American Bar Association
  - The appointment of defense experts for indigent defendants should be required whenever reasonably necessary to the defense.

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# Division of labor

- Between forensic analysis and interpretation

  When a lab report comes back, it should be transmitted to two forensic scientists—one representing the prosecution and one representing the defense—for interpretation

- Applies adversarial principle to forensics
- Fewer errors of interpretation will go unchallenged

  George Rodriguez convicted of rape because of improper interpretation of properly conducted blood serum analysis

# Vouchers

- An indigent suspect on trial should also have the right to select his own forensic counsel
- Use a government-issued voucher to pay for it

  Such forensic counselors would redeem their vouchers at the courthouse, receiving their paychecks from an officer of the court
- Forensic counselors would have an incentive to provide high-quality services

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# Privatization

- Each lab should be private & for profit
- Thus subject to

  civil liability

  administrative fines for poor performance
- Financial incentives to be reliable
- Easier to regulate, especially at federal level
- *Must* be a part of competitive self regulation

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# What about Cost?

- Only a fraction of cases would be subject to redundant testing
- Today
  - One lab per jurisdiction and one jurisdiction per lab
    - As a first approximation of a complicated situation
  - Hard to gain from economies of scale and scope
- Under competitive self regulation
  - Several labs per jurisdiction and several jurisdictions per lab
  - Gains from economies of scale and scope
- We do not need more resources; we need better organization

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# What about Cost?

- Competitive self regulation would ***save money***
  - for the criminal justice system
- Errors cost money

  Incarceration

  Restitution

  Appeal
- Forensic tests are relatively cheap
- Forensic science is a bargain for the criminal justice system

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# Cost Example 1

## Independent, triplicate fingerprint examinations in all felony cases going to trial

- 2% rate of false positive errors

  $9 million per year in new fingerprint examinations

  Eliminate 96% (1,628/1,696) of false felony convictions

  $152 million per year incarcerating wrongly convicted

  Net saving: $141 million per year

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# Cost Example 2:

Independent, triplicate fingerprint examinations in all felony cases going to trial

- 0.2% rate of false positive errors

  $9 million per year in new fingerprint examinations

  Eliminate 99.6% of 170 false felony convictions

  $15 million per year incarcerating wrongly convicted

  Net saving: $6 million per year

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# Organizational Design Problem

- Requires careful experimental research
- NSF grant #0622477
- We need more research
- Right now, however, we can implement redundant, independent fingerprint examinations in felony cases going to trial in any jurisdiction willing to try

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# Closing note

- Research science is organized by the principle of structural redundancy.
- Forensic science can be as reliable as research science,

  but **only if**

  it is (re)organized by the principle of structural redundancy.

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# End

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