



LAGOS FORENSIC  
— SYMPOSIUM —



# What's done cannot be undone: The potential of forensic DNA testing

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6th Lagos Forensic Symposium (Hybrid)  
October 19-20, 2022







To bed, to bed! there's knocking at the gate:  
come, come, come, come, give me your hand.

***What's done cannot be undone.***

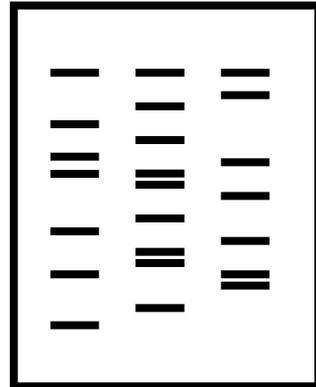
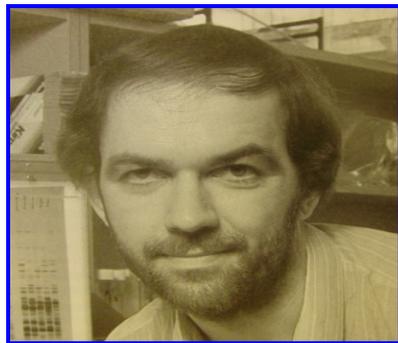
--To bed, to bed, to bed!

The Tragedy of Macbeth  
by William Shakespeare  
Act 5 Scene 1

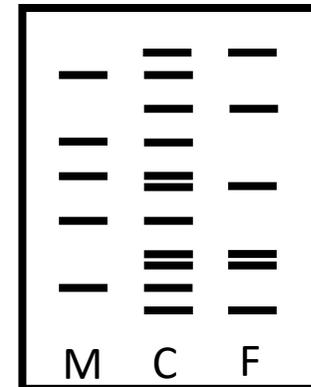
# Forensic DNA Testing – The Past

1984 – Dr. Alec Jeffreys discovers a highly polymorphic DNA marker in muscle cells of grey seals

Sir Alec Jeffreys



He notes the same marker exists in humans – and can explain the banding pattern as being inherited from each parent



The first application of this technology is for an *immigration case* in the UK



# Ghana Immigration Case (1985)

The mother – Christina Sarbah, living in the UK, wanted to bring her son, Andrew from Ghana to the UK.

UK immigration officials doubted that Andrew was the son of Christina. They reached out to Jeffreys for help.

Jeffreys tested both mother and son, and 3 other children of Christina and her husband.

The chance that Andrew is not a child of Christina was 1 in 1 trillion.

## Son rejoins mother as genetic test ends immigration dispute

By Andrew Veitch,  
Medical Correspondent

A MOTHER has been reunited with her son, thanks to a genetic fingerprint technique developed by scientists at Leicester University.

Immigration officials refused to allow 11-year-old Andrew Sarbah, from Ghana, to stay in Britain. They claimed that his passport was a forgery and that he was unable to prove that Mrs Christina Sarbah was his real mother as blood tests were inconclusive.

Dr Alec Jeffreys and his team were called in by the family's solicitors to analyse the Sarbahs' genes. In the first practical test of their technique they showed that the odds against Andrew not being his mother's son were 100,000 to one.

The Home Office accepted the evidence and has allowed Andrew to stay with his

mother, brother, and two sisters at their home in Hammersmith, London. Mrs Sarbah, a nurse, said: "It is terrific news, I have gone through hell."

The decision could prove to be a landmark. The Home Office is considering using the test to determine paternity in other immigration disputes, and the police are reported to be interested in its potential for identifying criminals. Thieves could be identified by the genes in a piece of skin or a drop of blood, rapists by the DNA in a single sperm.

Dr Jeffreys, from Leicester University's genetics department, reports the details of the Sarbah case in *Nature* magazine today. The technique works by exploiting the fact that everyone has small chunks of genes as unique as their fingerprints.

Dr Jeffreys explained: "In paternity cases you take

blood samples, extract the genetic material and process it with a probe that lights up the regions of the chromosome which have those very variable segments of genetic material.

"You get a DNA fingerprint on an X-Ray film. It looks like bar code, a series of stripes. You compare the stripes with those from the parents. Take away the stripes that must have come from the mother, and you're left the stripes that must have come from the father. If they all match, he must be the father. If virtually none match, he isn't. You get a clear result."

The Lister Institute for Preventive Medicine, a charity based at the Royal National Orthopaedic Hospital in Stanmore, Middlesex, holds the patents to the technique and is discussing the possibility of developing it commercially.

# Forensic DNA Testing – The Past

1983 – 15 year old Lynda Mann is found sexually assaulted and murdered (strangulation) in Leicestershire, England.



1986 – 15 year old Dawn Ashworth is found sexually assaulted and murdered in Leicestershire, England. The *modus operandi* of the crime was very similar to the Mann homicide.



The resulting police investigation developed a Person of Interest, Mr. Richard Buckland.

After a 3 day interrogation, Buckland confessed to killing Ms. Ashworth, but denied any involvement in the Mann homicide.

Detectives learn about the DNA profiling technique of Dr. Jeffreys and ask for his help to create a “slam dunk” case against Mr. Buckland.

Jeffreys determines the same male committed both crimes, and...

It wasn't Mr. Buckland!

# Forensic DNA Testing – The Past

- Police ask all males in three nearby villages to voluntarily give a blood sample ( $N \sim 5000$ ). ABO blood screening limits the number of actual tests performed.
- No matches.
- Months later – a patron at a local pub overhears a conversation by a man named Ian Kelly – he used a fake ID to give his blood in place of his good friend, Colin Pitchfork.

# Forensic DNA Testing – The Past

- Colin Pitchfork, a baker, is confronted by the police and donates his blood for DNA testing.
- He cannot be excluded.
- Pitchfork is sentenced to life in prison in 1988, with a minimum of 30 year sentence.



# Forensic DNA Testing – The Past

sky news

🕒 Tuesday 13 July 2021 19:57, UK

Colin Pitchfork, who raped and murdered two schoolgirls, to be released after government loses challenge

Pitchfork, now in his early 60s, was the first person to be convicted of murder on the basis of DNA evidence.

# Some thoughts on the first DNA case...

- Linked two separate crimes to the same perpetrator (identify serial rapist).
- Successfully brought the perpetrator to justice
- Resulted in the first exoneration of someone by using DNA
- For Mr. Buckland, what's done *can* be undone!!

# The Innocence Project

- 1992 – Peter Neufeld and Barry Scheck started the Innocence Project at Cardoza School of Law in New York.
- Today – 69 Innocence Project Network across the globe.

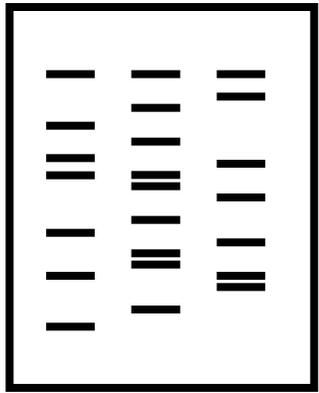


Peter Neufeld and Barry Scheck in 1989  
(Photo: Barbara Alper Photography).

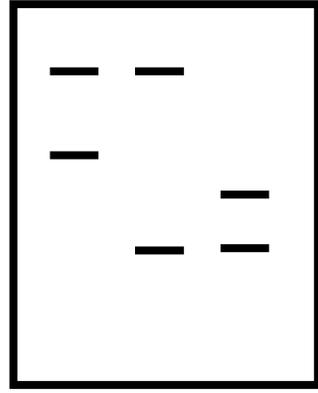
# Innocence Project Impact

- Over 375 Innocence Project exonerations to date
- Most of the exonerations are from DNA testing.
- Wrongful convictions:
  - 63% eyewitness misidentification
  - 26% false confessions
  - 17% involved informants
  - 52% faulty forensics

# The Evolution of DNA Testing



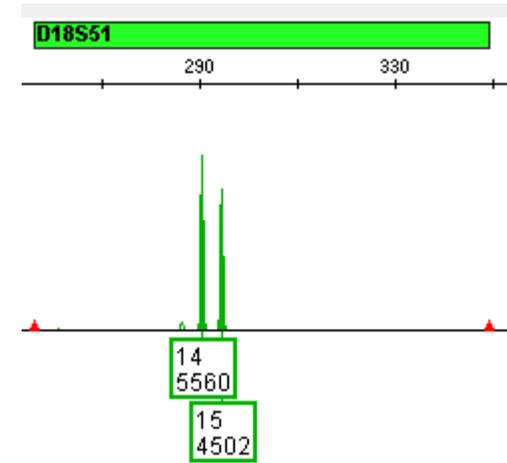
Multi-locus Probes



Single-locus Probes



PCR-Based Systems



Short Tandem Repeats



Combines the power of SLPs  
With the speed of PCR

# STR Testing – The Present

- The decision to move to STR testing combined the best of the “old” technology (highly discriminative markers) with the benefits from “new” technologies like PCR (faster results and combining multiple markers).
- This also allowed a “Common Currency” of core STR loci to be tested across the country.
- In the US – laboratories started building DNA databases to assist with crime scene evidence.

# Benefits of DNA Testing



# Results from the pilot study

- New York State Police - of the first 1,000 hits from testing minor crimes like burglary, the majority were linked to more serious crimes like sexual assault and homicide.
- Florida Department of Law Enforcement – 52% of people who had hits in CODIS for sexual assault and homicide had previously been entered into CODIS for burglary and drug offenses.

# Benefits of DNA Testing

Journal of Criminal Justice 39 (2011) 433–444



Contents lists available at SciVerse ScienceDirect

Journal of Criminal Justice



## Patterns of criminal achievement in sexual offending: Unravelling the “successful” sex offender

Patrick Lussier <sup>a,b,\*</sup>, Martin Bouchard <sup>a</sup>, Eric Beauregard <sup>a,b</sup>

<sup>a</sup> School of Criminology, Simon Fraser University

<sup>b</sup> Centre for Research on Sexual Violence, British Columbia, Canada

Mean number of sexual assaults committed per rapist = 7.10

2 types of “successful” offenders:

- (1) targets a victim that can be repeatedly abused for a long period without detection.
- (2) younger offender successful in the sense of being able to complete aggressions on multiple victims.

# Jennifer Doleac Study (2017)

## **The Effects of DNA Databases on Crime**

Jennifer L. Doleac

AMERICAN ECONOMIC JOURNAL: APPLIED ECONOMICS  
VOL. 9, NO. 1, JANUARY 2017  
(pp. 165-201)

Other studies have shown the cost-benefit of preventing serious crimes by (a) imposing longer jail sentences (about \$7,600) or (b) by hiring more police officers (\$26,300 to \$62,500).

In contrast, the marginal cost of preventing a serious offense using DNA profiling is only \$70 – and falling. DNA databases are between 100 and 1,000 times more cost-effective than these other common law enforcement tools.”

# Jennifer Doleac Study (2017)

## **The Effects of DNA Databases on Crime**

Jennifer L. Doleac

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In 2010, state and federal governments spent approximately **\$30.5 million** adding 761,609 offender profiles to DNA databases but saved **\$21 billion** by preventing new crimes (assuming each profile added to the database results in 0.57 fewer serious offenses with a cost savings to society of \$27,600).

## PAPER

### GENERAL; CRIMINALISTICS

*Can Wang,<sup>1</sup> M.S.; and Lawrence M. Wein,<sup>2</sup> Ph.D.*

## Analyzing Approaches to the Backlog of Untested Sexual Assault Kits in the U.S.A.

Examined the testing of backlog sexual assault kits in Detroit, Michigan

# Wang and Wein (2018)

- Testing all sexual assault kits in the backlog is quite cost-effective: for example, spending  $\approx \$1641$  to test a kit averts sexual assaults costing  $\approx \$133,484$  on average.



Contents lists available at [ScienceDirect](#)

## Forensic Science International: Synergy

journal homepage: <https://www.journals.elsevier.com/forensic-science-international-synergy/>



### The jurisdictional return on investment from processing the backlog of untested sexual assault kits<sup>☆</sup>

Paul J. Speaker

*John Chambers College of Business and Economics, West Virginia University, Morgantown, WV, 26505, USA*



# Paul Speaker Analysis

- The analysis demonstrates that the societal return on investment from the testing of all sexual assault kits ranges from **9,874%** to **64,529%**, depending on the volume of activity for the laboratory conducting the analysis.
- Benefits include those to survivors from a ***resolution*** to their assaults, the benefits to others from the ***prevention*** of repeated assaults from serial rapists, and the prevention of societal costs ***external*** to those directly victimized (friends and family).

What if... the offender is not in the database?



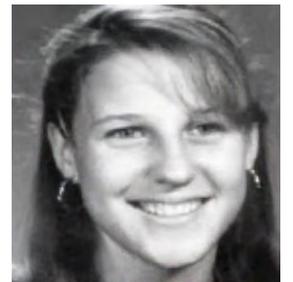
# Non-STR markers

- Haploid markers: Y-STRs or mitochondrial DNA testing.
  - Not Unique
  - No national databases to search

# Phoenix Canal Murders



- November 1992 – Angela Brosso (22) failed to return home from a bike ride.
- Her headless body was found soon later, followed by her head in the Arizona Canal.
- Ten months later in September 1993, Melanie Bernas (17) also went missing on a bike ride. Her body, discovered the following day, also was found in the canal.



# Phoenix Canal Murders

- No suspects.
- One person of interest interviewed after his girlfriend contacted police.
- Case goes cold – profile entered into CODIS.

# Phoenix Canal Murders

- ISHI Meeting in Phoenix (October 2014).
- Police detective attends the meeting and meets a genetic genealogist.
- She tells the detective if he can get a Y-STR profile, she can provide him with a last name.
- At the time, Sorenson Genetics was doing genealogy testing and had a Y-STR database (over 39,000) with the man's last name associated with the haplotype.



## Y-Chromosome Database

### THE DATABASE

[Sorenson Database](#)

**[Y-Chromosome Database](#)**

[Search the Y Database](#)

[Place/Time Analysis](#)

[Lineage Map](#)

[Paternal Surnames](#)

[Demographics](#)

[Statistics](#)

[Generation Interval](#)

[Marker Details](#)

[Marker Standards](#)

[Duplicated Markers](#)

[Marker DYS389](#)

[Marker DYS464](#)

The Sorenson Molecular Genealogy Foundation (SMGF) has built the world's foremost collection of Y-chromosome DNA data and corresponding genealogies. Currently, the Sorenson Y-database contains data from more than 35,000 men throughout the world.

Only males have Y-chromosome DNA, which is passed down virtually unchanged from father to son. This means that males with a common parental ancestor will have almost identical Y-DNA. In addition to their Y-DNA, men generally inherit their surnames from their fathers. This makes Y-DNA an excellent tool for surname research.

Searching the Sorenson Y-database by surname and/or by genetic marker values allows us to find cousins who may be connected across generations and around the world. Men who have similar genetic marker values and the same surname likely share a common ancestor. In general, the more marker values in common, the closer the relationship.

To search the Sorenson Database, simply go to the [Search](#) page and follow the instructions on the screen. You may enter DNA results obtained from a commercial lab or select the SMGF default values.

Women may also search the Y-Chromosome Database for the surname of their father or brothers.

If you have not participated in the SMGF project, [click here](#) to learn how to add your DNA results and pedigree chart to the Sorenson Database.

"It is our hope that many others can enjoy the same sense of connection and belonging that SMGF has helped our extended family to experience."

Kevin Stephenson,  
Singapore

# Phoenix Canal Murders

- Late December 2014 - Genealogist tells the detectives – maybe someone with a last name of “Miller”
- Police find four people in their files with the last name of Miller.
- Follow Bryan Miller and collect a discarded cigarette butt.

# Phoenix Canal Murders



**Bryan Patrick Miller, suspect in the grisly 1990s canal slayings.** *(Photo: Maricopa County Sheriff's Office)*

DNA testing matches the evidence from the 1990s

Miller is arrested in January of 2015

Arizona now conducts Familial Searching

# Limits of Ys/name searching

- Privacy concerns – people that are looking for ancestors are not necessarily agreeing that their DNA can be used in these investigations.
- Genetic Genealogy companies have now removed many of these public databases like Y-Search.
- China collects and maintains a Y-STR database of offenders and it has been useful to identify a serial killer.



Gao Chengyong – arrested for the Sexual assault and murder of 11 women and girls from 1998-2002

# DNA Testing –The future\*

- Familial Searching – trying to identify a close relative of the unknown POI (e.g. a brother, father, or son).
- Use of public genealogy databases such as GEDmatch to identify distant relatives (Ray Wickenheiser will talk about this).

\*The future is here!

# Conclusions

- DNA testing has made a positive impact on the criminal justice system over the past 35 years.
- There are still challenges ahead – especially with interpretation of complex DNA mixture evidence.

Thank You!



- Dr. Richard Somiari (ITIS, LLC)
- The organizing committee of the Lagos Forensic Symposium
- Colleagues at the UNTHSC Center for Human Identification

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