

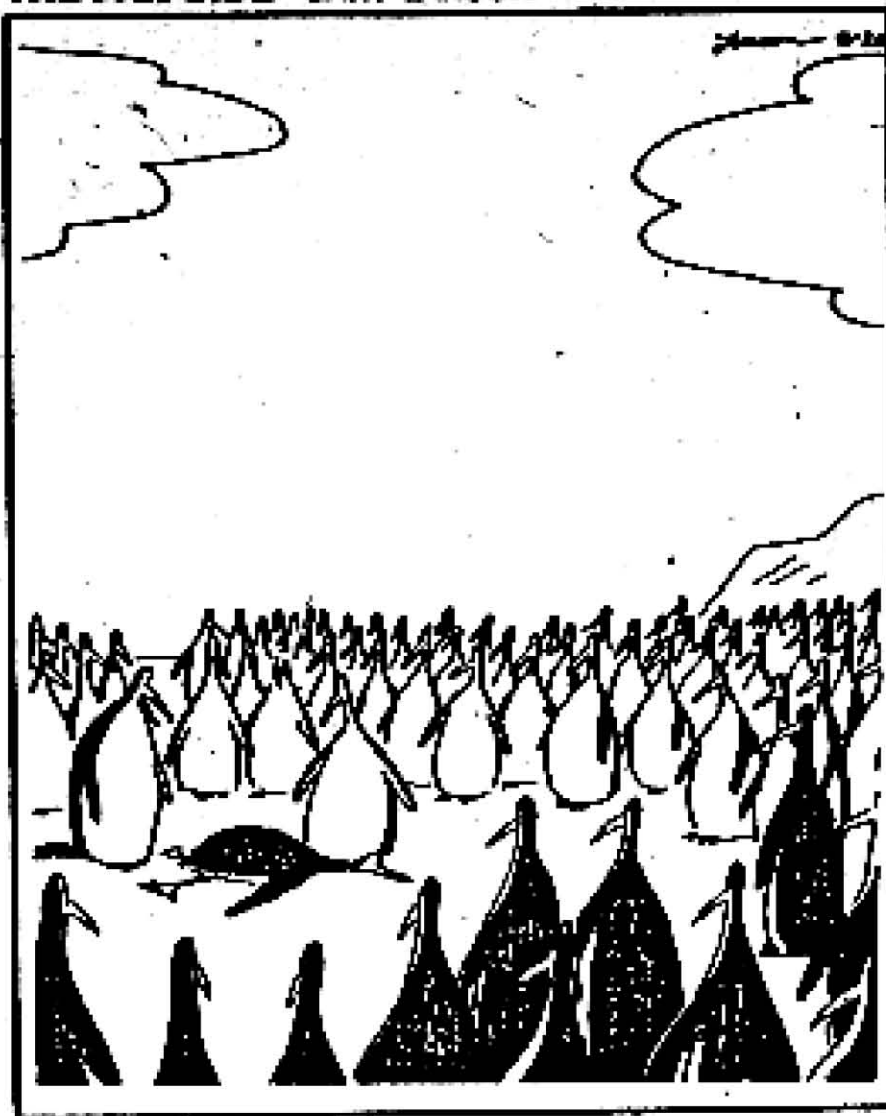
# Issues in the Use of Genetic Technologies in Forensics



# Forensic Science

- How are DNA technologies being used for forensic purposes?
- From whom are samples collected for criminal justice and identification purposes? Expansion?
- Are these samples made available for other uses?
- Privacy?
- How are Federal and State forensic DNA policies and databases coordinated?
- Legal and social issues being raised?

**THE FAR SIDE GARY LARSON**



**“He’s dead, all right-beaked  
in the back-and you know this  
won’t be easy to solve.”**

# Forensic Science

- Application of science in the investigation of legal matters
- Scientific knowledge and technology are used to serve as witnesses in both criminal and civil matters
- Science may not offer definitive solutions for all scenarios; it does provide a special investigative role
- Goal is “attribution” – i.e., who committed the crime



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JEFF  
PARKER

**DNA**  
EVIDENCE

# Human Identity Testing

- Forensic cases – criminal, civil
- Paternity testing -- identifying father, nursery mix-ups, immigration, inheritance
- Historical investigations
- Population studies, human diversity, anthropology
- Missing persons investigations
- Mass disasters
- Military DNA “dog tag”
- Convicted felon DNA databases
- patient sample mix-ups

# DNA Analysis Overview

- Forensic testing (Criminal)
  - ~20,000 cases per year in U.S.
  - 75% involve sexual assault
- Paternity Testing (Civil)
  - ~250,000 cases per year in U.S.
  - now use DNA, not serology
- Exclusions
  - ~30% of all test results

# Tissue Sources

- blood
- semen
- tissue
- bone, tooth
- hair root
- saliva
- urine



# Methods

- RFLP/VNTR typing
- PCR - HLA-DQA1, Polymarker loci by reverse dot blot assay (SNP)
- PCR – D1S80 locus (VNTR) typing by electrophoresis and silver staining
- PCR – STR loci typing by capillary electrophoresis and fluorescence
- PCR – mitochondrial DNA by capillary electrophoresis and fluorescence
- PCR – Y STR loci by capillary electrophoresis and fluorescence
- PCR - SNPs





# Kosovo

**124 Bodies  
Recovered**





# World Trade Center (AA #11, UA #175)



9/11/01

# Abduction/Murder

**REWARD**

**\$150,000.<sup>00</sup>**

For the arrest and conviction  
of the person or persons  
responsible for the murders  
of these children.



Kristin Lisk



Kati Lisk



Sofia Silva

**1-800-729-1411**

**Predators after  
our children**





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Saturday, February 02, 2002

### 3-year-old DNA sample leads to arrest in rape

By **Janice Morse**  
The Cincinnati Enquirer

**HAMILTON** — A DNA sample took more than three years to make its way through the system, but it led to a suspect's indictment this week in a Butler County rape case.

Charles S. Courtney Jr., 37, of Hamilton, is accused of robbery, kidnapping and three counts of rape in an April 21, 1998, attack on a 21-year-old Hamilton woman in Fairfield. The woman reported she was abducted at a grocery store, raped in the 4900 block of Factory Drive and robbed of her purse.



**Courtney**

A DNA sample from that crime arrived at the state crime lab three days later. But it took until November 2001 for the sample to be analyzed and added to the national Combined DNA Index System (CODIS), where it matched DNA from Mr. Courtney, said Bret Crow, Ohio attorney general's spokesman.

It was unclear Friday how long Mr. Courtney's DNA had been in CODIS, so it's hard to tell whether faster processing of

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**THE BLADE**  
**toledoblade.com**  
 Tuesday, May 28, 2002

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News

Courts | Article published Friday, May 24, 2002  
**Lima man gets 6 years for vehicular homicide**

LIMA, Ohio - A Lima man was sentenced to six years in prison yesterday for causing the death of a Delphos man in a crash that initially baffled police.

Stephen Williams, 34, pleaded guilty last month to aggravated vehicular homicide in connection with the death of Robert Caskey, Jr., 41. Judge Jeffrey Reed sentenced Williams in Allen County Common Pleas Court.

Mr. Caskey was found lying facedown near his minivan on Lima's south side Sept. 2, 2000. His body had struck a utility pole, and police say they believe he was hanging onto the outside of the van when the crash occurred.

Only hours before he died, the victim had turned over about \$15,000 in cash to Delphos police that was later determined to have been stolen, but Lima police said the automobile crash that caused his death was unrelated.

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MOMENT OF FREEDOM

# After falsely serving 19 years, Danny Brown is home

BY DALE EMCH  
BLADE STAFF WRITER

For almost two decades, Danny Brown hadn't walked outside a prison without his wrists being shackled and armed guards at his side.

Yesterday, he emerged alone and unchained from the Lucas County jail into the pale afternoon sunshine shortly after a judge granted him a new trial for a murder he's been imprisoned for since 1981.

A chorus of "hallelujahs" rained down from about two dozen friends and family members who waited for his release at the back door of the jail. Before he could take his first two steps of freedom, his mother, Fannie Brown, swept him into her



Danny Brown hugs James McCloskey of Centurion Ministries, who was involved in his fight to get a new trial. THE BLADE/LISA DUTTON

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# DNA test frees man, implicates brother

BATON ROUGE, La. (AP)—A man who spent 19 years in one of the nation's toughest prisons until DNA tests exonerated him—and implicated his brother—says he believes in his brother's claims of innocence.

"I'm not angry, I'm not bitter, but

lawsuit March 29 against Terrebonne Parish prosecutors who blocked the DNA testing, alleging civil rights violations and wrongful imprisonment.

He was 28 when he was sentenced to life in prison for raping a 26-year-old nurse near a house

# Witnesses' statements are much harder to get

Too often these days, police say, they find themselves rolling up to crime scenes where all they find is a body and a lot of uncommunicative witnesses.

That was the case with the murder of Timothy Mims.

Mims and two friends were painting the inside of his home in Shreveport, La., on Sept. 30, 1999, when a teal green car resembling a Pontiac Grand Am or a Ford Taurus pulled up outside.

Three young men got out. All of

city of nearly 200,000 residents.

The gunmen entered the house. One gunshot rang out. Mims died several hours later, a .38-caliber bullet in his back.

When Shreveport Police Detective Tom Oster arrived at the scene, he quickly saw a possible motive. An empty shoebox with marijuana residue inside lay in plain sight, along with little plastic baggies used to package drugs. Any doubt that this was a drug-related crime ended when officers found a two-pound brick of marijuana wedged between the headboard

nesses, or so he thought. Despite being in the room with Mims when the shooting began, neither witness could give Oster descriptions of the three suspects.

The detective says one of the men told him he only saw a pistol coming in the front door. The second said he saw nothing.

There is little physical evidence in the fatal crime except for the bullet taken from the young man's body, and without witnesses, Oster has little to go on.

For Shreveport, Mims' death is one

Of 36 murders, authorities closed 86% of them.

Oster says the case is typical of what authorities face these days. In the 1960s, homicide cases were built around the statements of witnesses. "There were people telling you what they saw. You can write that off now," he says.

More than four months after the killing, Oster is convinced that Mims' friends saw a little more than they are saying. "They knew what was going on," he says.

However, you can't make a witness



# For those on the fringes, leads harder to come by

Tami Lynn Heckman could not pass a stray animal and ignore it. But the sensitive girl who could cry at the sight of a hungry puppy had a darker side. Heckman was a prostitute who liked cocaine.

Her mother, Sue Carter, says she often told her middle daughter that she wouldn't live to see 21 if she remained a "working girl." Heckman died with three bullets in her back on May 13, 1983, in her hometown, South Bend, Ind. She was 20. Her killer has never been caught.

Carter believes that the police investigating the murder then put the case "up on the shelf" quickly. "If your child wasn't perfect little Susie Jones, cheerleader, the college graduate or woman of the year, it was like it could

Police believe she was riding in her car and was jumping from the vehicle when she was shot with a gun she had carried in her purse. She ran about a block to the house where she died. It was 1:56 a.m. The gun was never found. There were no usable fingerprints in the car. The person who found Heckman didn't see anything.

Mike Swanson, who heads the St. Joseph County special crimes unit, says Heckman's occupation "makes no difference to us. She's a victim. Regardless of what she did beforehand, she's a victim."

Swanson says the real problem is that the case "is a little short on evidence."

He says a detective recently reviewed the case and is looking at some leads. De-

## FEATURE ARTICLE

# The Role of DNA Evidence in Finding and Convicting My Assailant

*By Debbie Smith  
Williamsburg, Virginia*

*Editor's Note: The text of this article was presented orally by Mrs. Smith to the participants at the 10th International Symposium on Human Identification, on September 30, 1999. Because of the tremendous response that we received from participants, we have asked Mrs. Smith to let us print her story here. Below is her narrative.*

### INTRODUCTION

03-03-89; 9342-00 through 9342-05. Numbers of Identification: 8905010; C89-1968. Human Identification: 180907; 89-85-00-0234. Written and spoken without a particular face impressed on the mind. 228-00-0009; 214515HA4; VA654195. Cold, impersonal...necessary numbers of







By Andrea Melendez, Rochester (N.Y.) Democrat and Chronicle, for USA TODAY

**Daughter slain: Ann and David Scoville want larger DNA databases.**

the death penalty. His move injected the DNA issue into the presidential campaign and reflected the growing importance of DNA testing in capital punishment cases.

A day after Bush said he would back a reprieve, Virginia Gov. Jim Gilmore ordered new DNA tests for a man whose death sentence for murder was commuted to life in prison six years ago because a DNA profile raised doubt about his guilt. Now, with more sophisticated test-

In California, Assemblyman Ken Maddox, a Republican from Orange County who wants all felons tested, was on the short side of a party-line vote by a Democrat-led panel. The loss was galling for Maddox, a former cop who knew the power of DNA. In 1996, a database linked a convict to a murder for which another man had been arrested. The case had been investigated by Maddox's ex-colleagues.

"I thought it should have been a

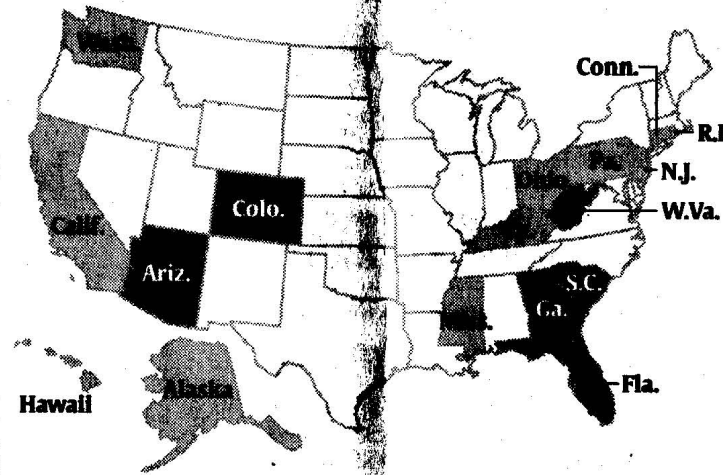
**Va. leads convict DNA collection**

Virginia, the first state to have a DNA database, continues to lead other states, as of Jan. 1, in collecting samples from convicts. Meanwhile, proposals to expand DNA testing have failed in 11 states this year and have been approved in six.



**Status of legislation expanding DNA testing of convicts**

■ Proposals failed   ■ Bills approved



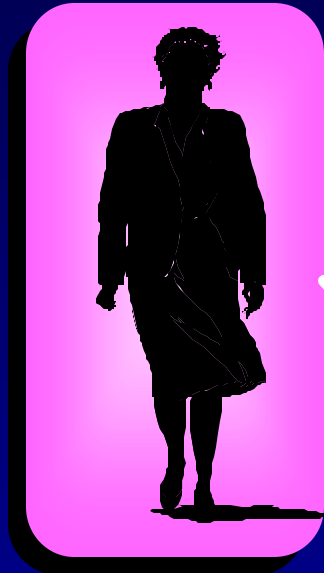
Sources: FBI; Smith, Alling, Lane law firm; USA TODAY research

By Frank Pompa, USA TODAY

# PATERNITY TESTING

**MOTHER**

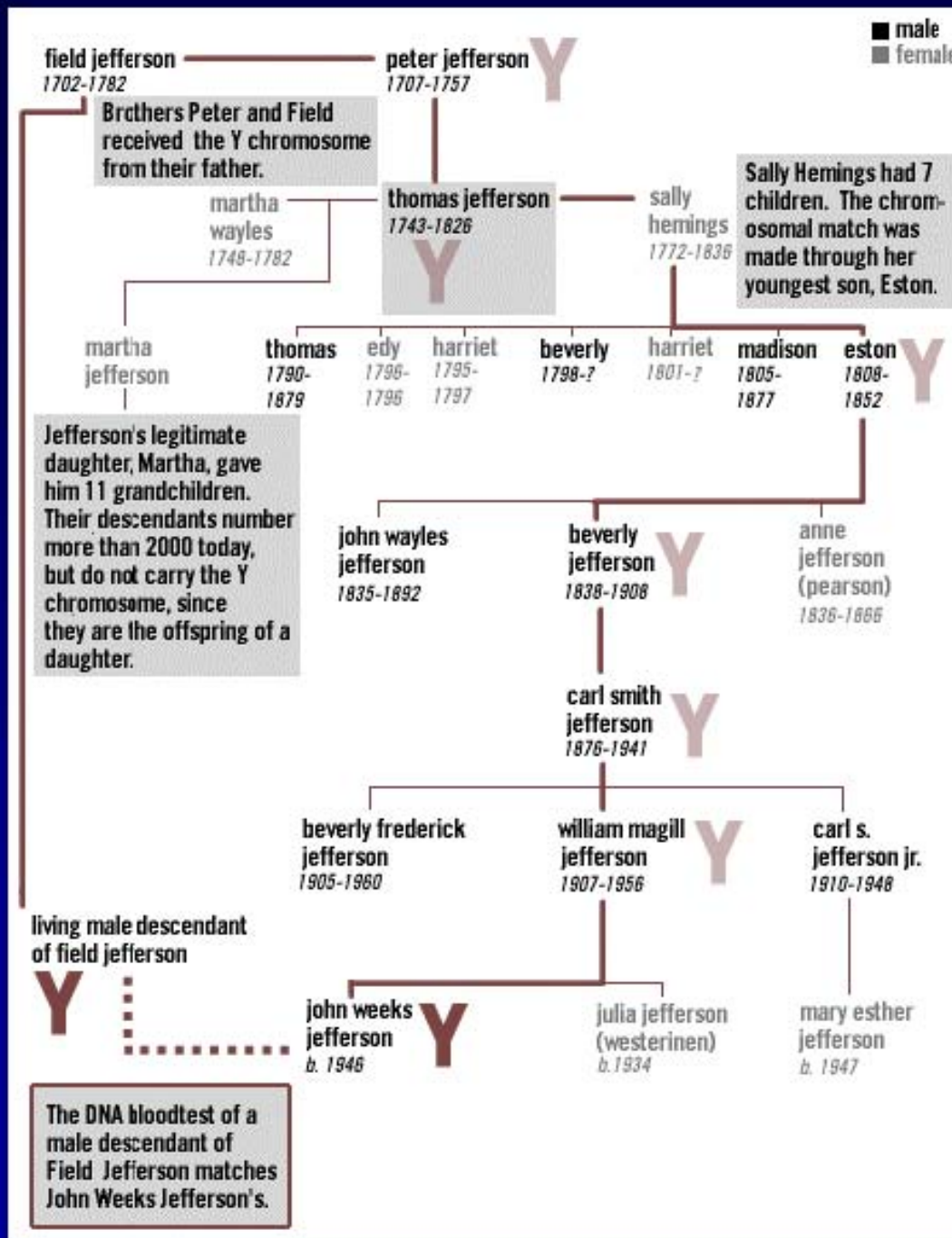
**ALLEGED FATHER**



**CHILD**



**Two alleles for each  
autosomal genetic marker**



Evidence

Snowball



Cat Hair

Draw Blood

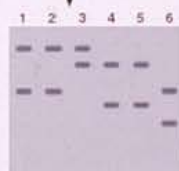
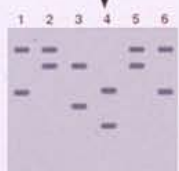
Extract DNA

Extract DNA

DNA

DNA

PCR Amplification

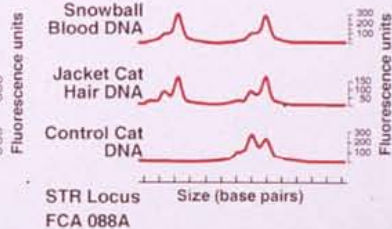
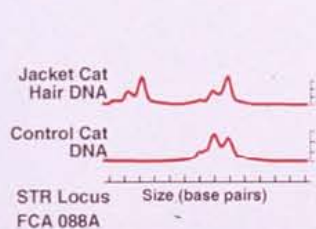


Electrophoresis of 10 STR Loci

Fluorescence Intensity Scanning

Scan of Genotyping Gel

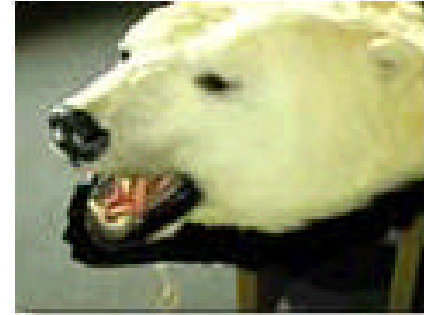
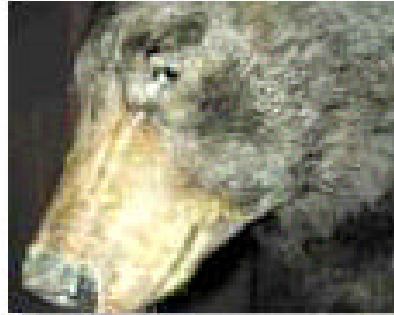
Scan of Genotyping Gel



Determine DNA Genotypes



# Non-human DNA Applications



**Wildlife issues are applying DNA methods  
more frequently**

 **Smuggling**

 **Poaching**

 **Population management**

# Botanical Witness for the Prosecution



DOUG SOKELL/VISUALS UNLIMITED

**Rugged individual.** Palo Verde trees show a lot of genetic variation.

# Database

- ✍ A database is an organized file or files of data that can be searched to **retrieve information**
- ✍ DNA databases compare crime scene evidence to a database of DNA profiles obtained from convicted offenders for **investigative leads**



***COODIS***

# Database Files

 Convicted Offenders File

 Forensic File

 Missing Persons File

 Relatives of Missing Persons File

 Human Remains File

 Population Statistics Files

 Suspect Files

# DNA Databasing Creates Other Successes

- Collaboration and cooperation - laboratories work together and continue to work together on **technology**
- Laboratories collaborate on **business** processes
- Laboratories work together on **investigations**
- Laboratories continue to provide **new ideas** for DNA typing and data banking

# DNA Databases

## Implemented or Planned (2002)

Australia

Austria

Belgium

Canada

Croatia

Czech Republic

Denmark

Estonia

Finland

France

Germany

Hong Kong

Hungary

Italy

Netherlands

New Zealand

Norway

Northern Ireland

Poland

Portugal

Scotland

Singapore

Slovak Republic

Slovenia

Spain

Sweden

Switzerland

United Kingdom

United States

While there are different policies and practices among countries that employ forensic DNA databases,

the genetic data are sufficiently compatible for exchange on an international level to assist in resolving crimes

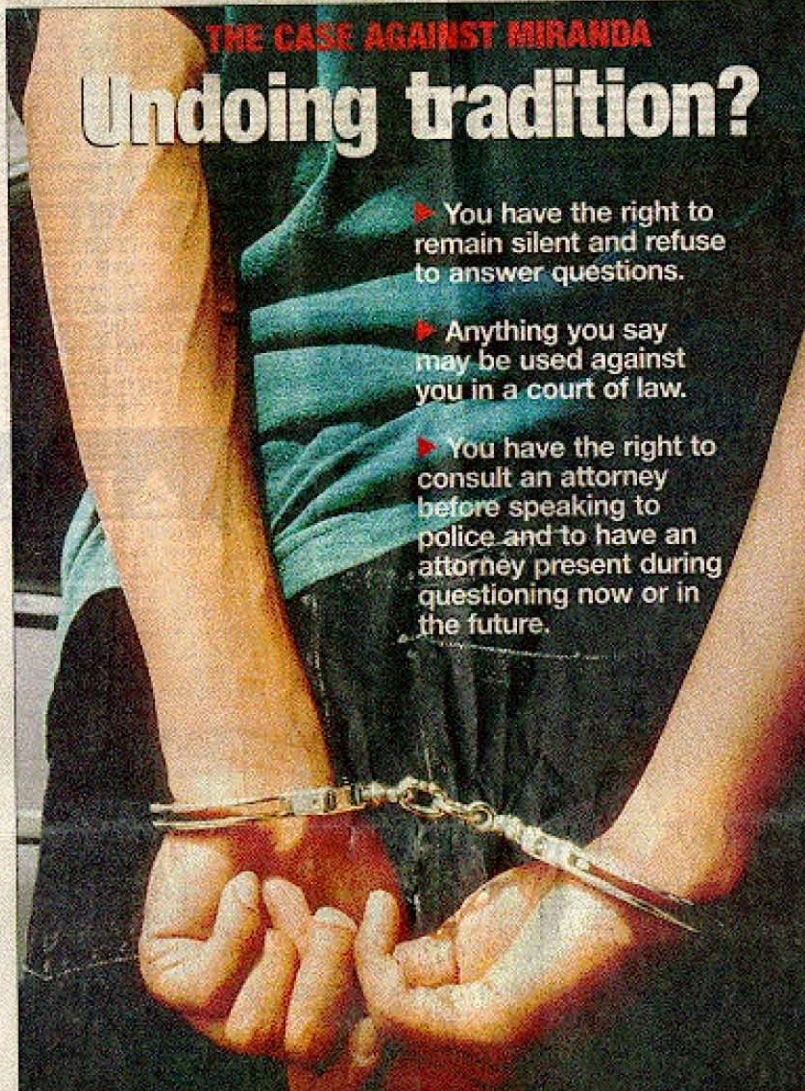


# With Success

- **Expansion of crimes**
- **Expansion to include arrested persons**
- **Expansion to include indicted persons**
- **Terrorism related offenses**

# Rights of the Individual vs. Society

## Reno: Study broad DNA testing



THE CASE AGAINST MIRANDA

### Undoing tradition?

- ▶ You have the right to remain silent and refuse to answer questions.
- ▶ Anything you say may be used against you in a court of law.
- ▶ You have the right to consult an attorney before speaking to police and to have an attorney present during questioning now or in the future.

### Commission would consider sampling everyone arrested

By Richard Willing  
USA TODAY

Attorney General Janet Reno has asked a federal commission to study the legality of taking DNA samples from everyone arrested instead of just the convicted sex offenders and violent felons currently permitted by law.

Such widespread testing would hugely expand government's reach by placing the genetic fingerprints of millions of Americans into state crime databases even if they never were convicted of a crime.

The study is to be announced in Dallas today at a meeting of the National Commission on the Future of DNA Evidence. The commission, a panel of judges, defense lawyers, police, prosecutors and scientists, will conduct the study.

Driving Reno's request: a new law in Louisiana and proposals in North Carolina and New York City to permit widespread testing.

"This doesn't imply an endorsement one way or another," said John Bentivoglio, a Justice Department attorney who is Reno's chief privacy adviser. "It does reflect (Reno's) deep interest and commitment in using our law enforcement tools in a manner that is sensitive to privacy rights."

New York City Police Commissioner Howard Safir, who has proposed DNA testing for everyone arrested in his jurisdiction, backs the study. "This is not an invasive process, and if it's used properly it's going to protect society," he said.

Taking DNA from convicts has been upheld by courts for

### Sweepstake controversy cuts sales of magazines

By Tom Lowry  
USA TODAY

NEW YORK — New subscriptions to magazines have fallen dramatically in the past year as regulators have accused sweepstakes companies of misleading consumers.

Subscriptions through two of the biggest sweepstakes firms, American Family Publishers and Publishers Clearing House, are down about 30%, industry executives and analysts say.

"We have relied on sweepstakes — maybe too much so," says David Leckey, head of circulation for Hachette Filipacchi Magazines, publisher of *Woman's Day*, *Elle* and *Car and Driver*.

"People are beginning to see all sweepstakes as bad."

For more than a year, regulators have been cracking down on the pitches used in mailings by sweepstakes firms.

State attorneys general accuse the industry of misleading consumers, particularly the elderly, into believing they have won large cash prizes or must buy magazines or other products to enter the sweepstakes.

Federal law says no purchase is necessary to play.

Less enticing wording on



# Data Stored

- Persons convicted of specified crimes
- Crime scene specimens
- Unidentified human remains
- Relatives of missing persons
- Suspects???
- DNA Samples

# Data Stored Privacy

- Can suspects (exonerated) be searched against other cases at a later date?
- Can human remains be searched against unsolved cases?
- Privacy protection for relatives of missing persons!
- Should DNA samples be stored?

# Preserving Prosecutions

- Old cases may fall under statute of limitations
- Describe unknown perpetrator by DNA profile (John Doe warrant)
- Extend Statute of Limitations
- Repeal or eliminate Statute of Limitations

# Privacy Concerns

- To Address concerns that DNA data & samples will be used inappropriately
  - **Limited Access** to the DNA data & samples by Law, Regulation, Policies/Procedures
  - Employ Law Enforcement Identification Markers [useful for **identification purposes only** and does not reveal “medical or disease-related information”]

# Federal Law

# DNA Identification Act of 1994

- Authorized a National DNA Identification Index
- Requirements for the type of information contained in the Index, and
- Requirements for Participation in the Index.
  - 42 U.S.C.A. §14132



# Type of Information

- DNA records of Persons Convicted of Crimes
- Analyses of Samples Recovered from Crime Scenes
- Analyses of Samples from Unidentified Human Remains
- Analyses of Samples Voluntarily Contributed by Relatives of Missing Persons (1999 Amendment)

# Type of Information

- Index shall include only Information –
  - Based Upon Analyses Performed by or on behalf of a Criminal Justice Agency in Accordance with the FBI Director's **Quality Assurance Standards**;
  - Prepared by Laboratories and Analysts that Undergo Routine (twice a year) External **Proficiency Testing**;  
and

# Type of Information

- Index shall include only Information –
  - Maintained by Federal, State and Local Criminal Justice Agencies that allow **limited disclosure** of stored DNA samples and DNA analyses.

# Limited Disclosure

- Very Limited Access to DNA Samples & Analyses
  - To Criminal Justice Agencies for **Law Enforcement Identification** Purposes;
  - In **Judicial Proceedings**, if otherwise admissible pursuant to applicable statutes and rules;
  - For **Criminal Defense Purposes**, to a defendant who shall have access to samples and analyses performed in connection with his/her case;

# Limited Disclosure

- Very Limited Access to DNA Data & Samples
  - If **Personally Identifiable Information is Removed**, for a Population Statistics Database, for Identification Research and Protocol Development Purposes or for Quality Control Purposes.



# QC And Privacy Requirements

- DNA Act expressly provides that **ACCESS** to the National Index is subject to **CANCELLATION** if these QC and Privacy Requirements are not met.

# Federal Privacy Requirements

- Imposed on States
  - Through Participation in the National DNA Index System - NDIS [42 U.S.C.A. §14132]; or
  - Through their receipt of Federal Byrne Grant [DNA Act, §210302] or Forensic DNA Laboratory Improvement Program Funding [42 U.S.C.A. § 3796kk *et seq.*].

# Federal Privacy Requirements

- Imposed on States by --

Federal Law

# Federal Privacy Requirements

- Federal Statutory Requirements Imposed on States –
  - For Participation in NDIS - Express Provisions in the Memorandum of Understanding that Must be Signed by State Official Having Authority to contract on Behalf of the State

# Federal Privacy Requirements

- Federal Statutory Requirements Imposed on States –
  - For Receipt of Federal Funding - Express Provisions in the Statutory Assurances Form that Must be Signed by the Head of the Agency Applying for the Grant



# State Law

Data are a little dated, but indicative of issues

# Penalties for Unauthorized Disclosure

- Over 60% of the State laws contain provisions that penalize the unauthorized disclosure of DNA data &/or samples
  - Most state laws penalize as a misdemeanor offense

# Penalties for Tampering with DNA Sample

- Fifteen State laws contain provisions that penalize attempts to tamper or tampering with a DNA sample
  - Most state laws penalize as a felony offense

# Disease Associations

- ✍ Certain associations with STR loci and disease have been reported
- ✍ Expansion repeats have been directly involved in certain diseases
- ✍ The forensically employed STRs do not encode proteins and thus are believed to not be associated with characteristics that may impact on privacy of the individual
- ✍ Relative risk is so low to provide any information (do not confuse association with direct relationship)

# Associations

- ✍ TH01 (an STR) in first intron in the gene tyrosine hydroxylase (TH)
- ✍ TH locus encodes an enzyme involved in synthesis of catecholamines
- ✍ TH locus is a candidate gene for associations with neuropsychiatric diseases - bipolar disease and schizophrenia
- ✍ There may be mechanisms that are involved with TH



# Associations

TH01 10 allele has been reported to be associated with SZ (French Tunisian)

No family history associated with allele

Other studies show no association with 10 allele

No data support prediction for susceptibility to BPD or SZ

Even if one could use TH01 data the value is low

0.5-1.0% of population has BPD, if TH01 had a relative risk of 2, the individual's relative risk would increase to 1-2%

# Conclusions

- How are DNA technologies being used for forensic purposes?
- From whom are samples collected for criminal justice and identification purposes? Expansion?
- Are these samples made available for other uses?
- Privacy?
- How are Federal and State forensic DNA policies and databases coordinated?
- Legal and social issues being raised?



SCIENCE MADE THEM...  
BUT NO MAN OWNS...

# THE DNAGENTS

16  
1987

