

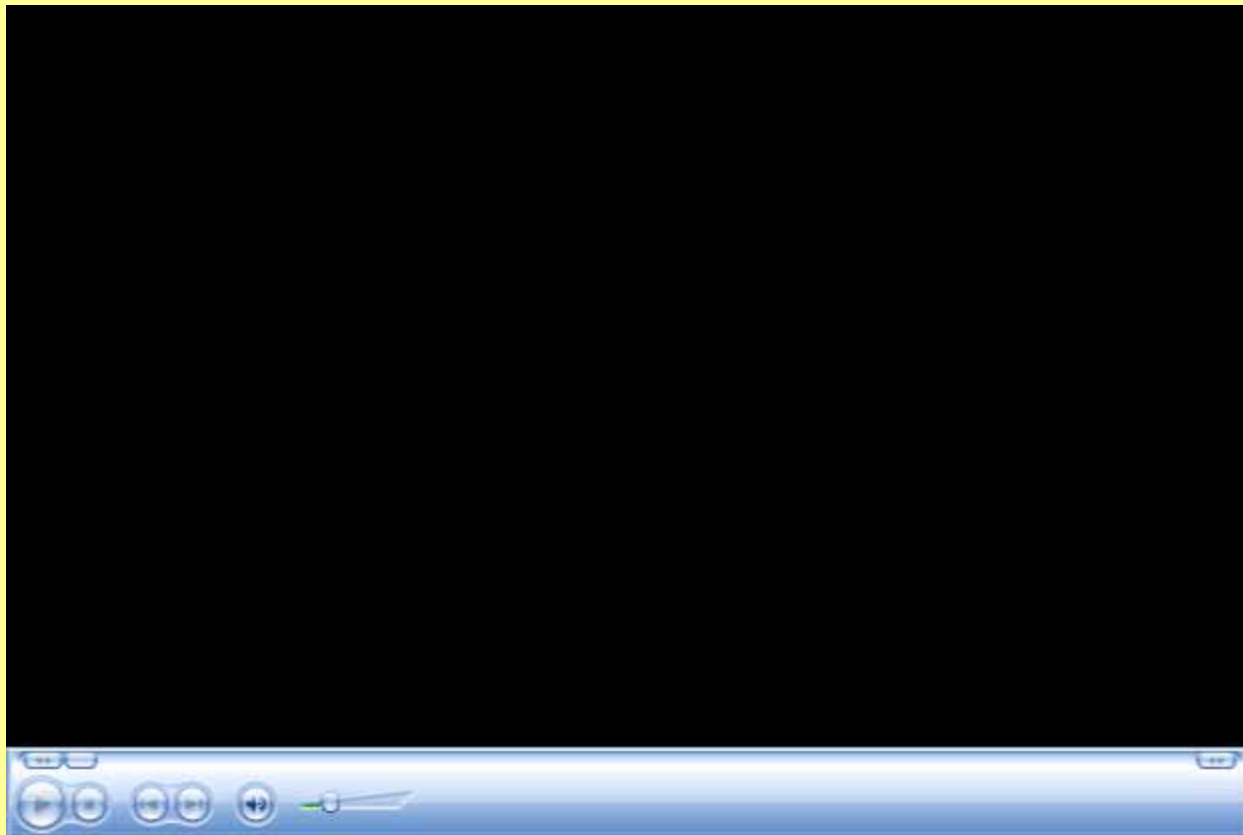
Demystifying DNA Profiles and CODIS: Privacy and other Issues



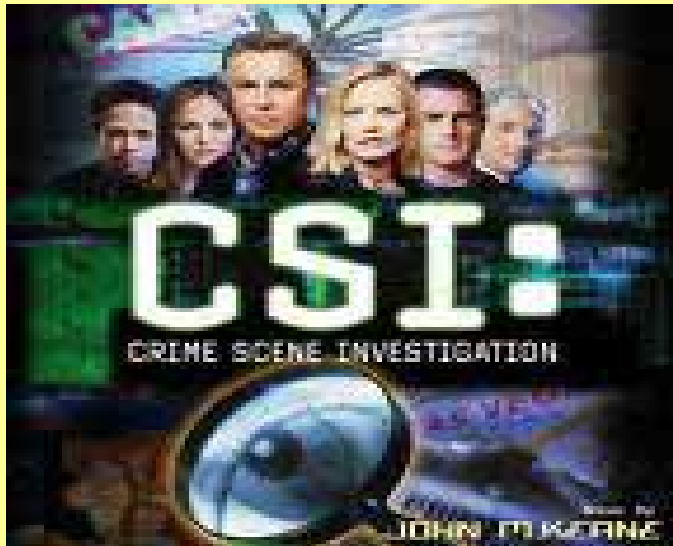
**Michelle Groves
CODIS State Administrator
Maryland State Police**

TV SHOWS HAVE BROUGHT FORENSIC SCIENCE INTO THE SPOTLIGHT

Quincy in the late 70's/early 80's



CSI within the last 10 years



Demystifying DNA Profiles and CODIS: Privacy and other Issues

- These shows and others like them are what the general public is using for education.
- Jurors expect forensic evidence
- While shows like CSI have brought popularity to forensic science there are many misconceptions.

Demystifying DNA Profiles and CODIS: Privacy and other Issues

- What is DNA and how is it useful for law enforcement?
- Different types of DNA analysis
- CODIS (Combined DNA Index System)
- Maryland's Offender and Arrestee Laws
- Hits in Maryland

What is DNA?

- DeoxyriboNucleic Acid
- DNA is the genetic material present in the nucleus of cells which is inherited half from each biological parent. An individual's DNA is unique except for identical twins (who have different fingerprints)
- DNA is sometimes called a genetic blueprint because it contains all of the instructions that determine an individual's genetic characteristics
- A person's DNA is the same in all cells in the body (except red blood cells which have no DNA)

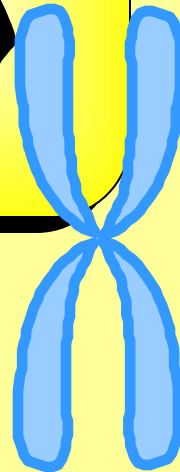
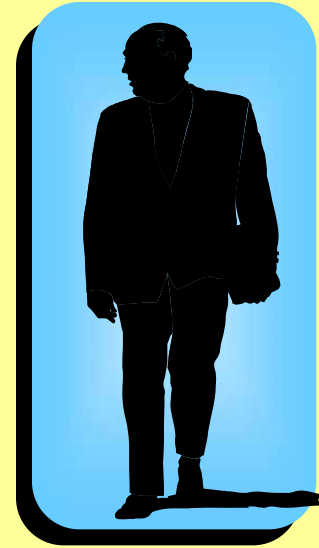
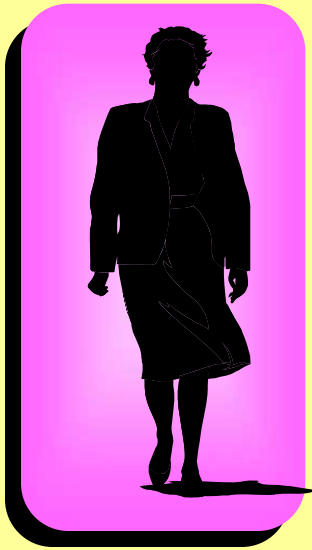


What is DNA?

- Eye color
- Hair color
- Shape of nose
- Codes for different functions in the body
(how to breathe)

The uniqueness of DNA is why it is such a useful tool for law enforcement.

Everyone inherits one copy of DNA from their mother & one from their father

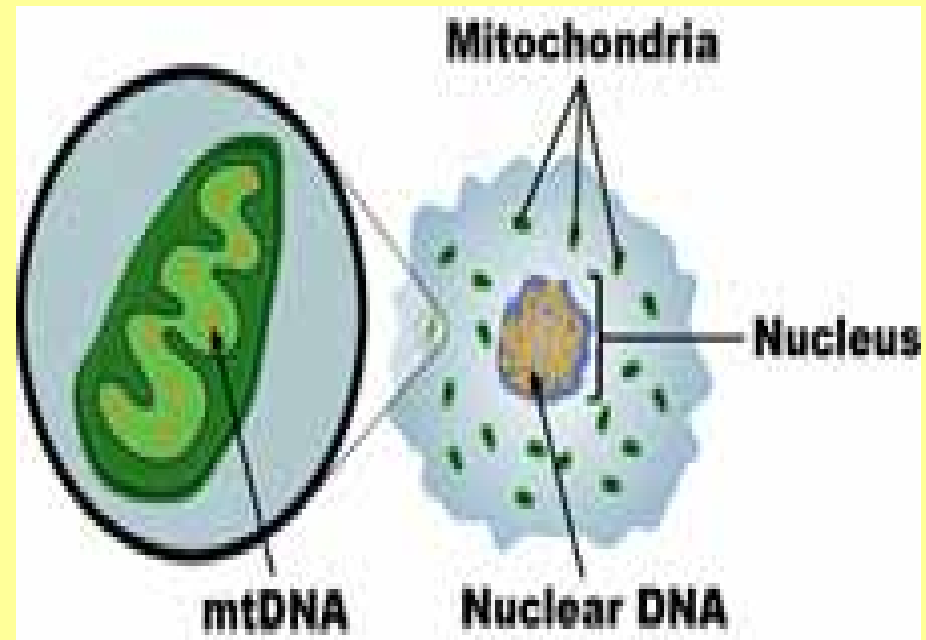


Polymorphism

- **99.9% of all DNA is the same among human beings**
- **Scientists use a small amount of the remaining .1% for testing because of the high amount of variability in that remaining amount (called polymorphism)**

TYPES OF DNA

- Nuclear DNA is located in the nucleus of the cell
- Mitochondrial DNA (mtDNA) is found in cell cytoplasm
- Both are used in forensic DNA identity testing



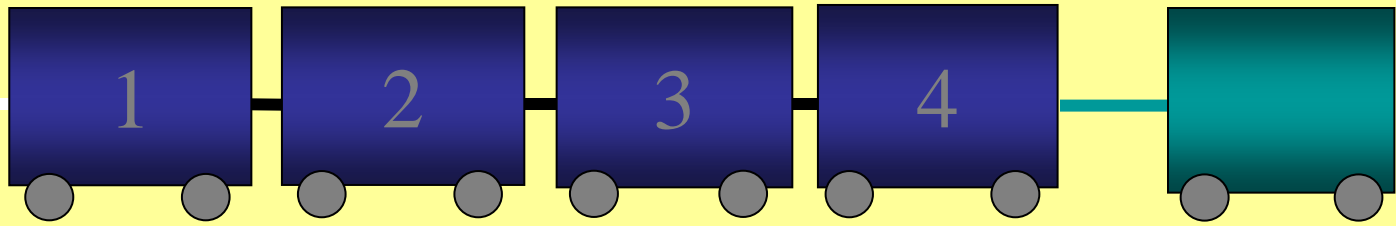
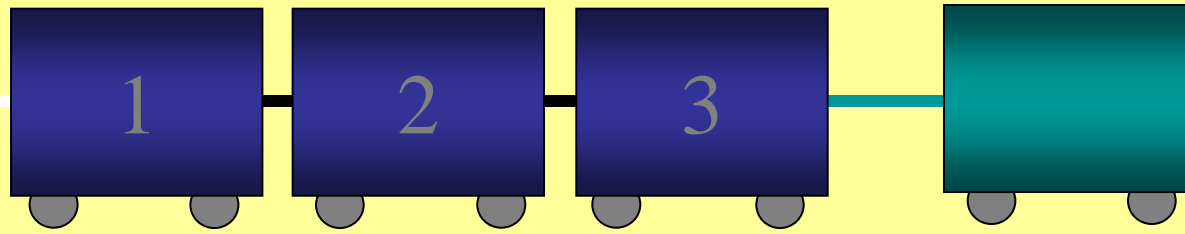
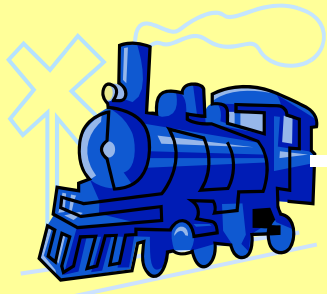
What is DNA?

- About 95% of DNA is noncoding, which means that it does not code for any physical characteristics
- The “junk” DNA is valuable for identity testing but does not reveal any physical or genetic attributes of the person whose DNA is being tested

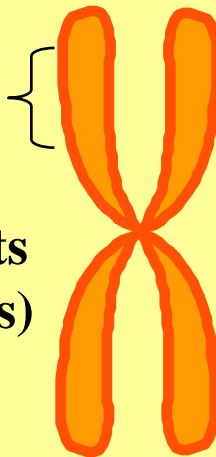
What is DNA?

- "DNA marker" refers to a specific chromosomal location that is analyzed in the forensic DNA laboratory.
- The most widely used DNA markers are defined by their 'Short Tandem Repeat' (STRs) characteristics on the chromosome.
- Multiple DNA markers can be analyzed in one test, or multiplexed, thus making the analysis process faster than previous technologies. This also gives the results a higher power of discrimination.

STR's

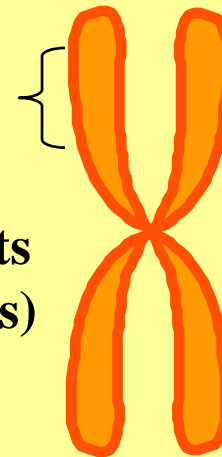


Allele
Mom



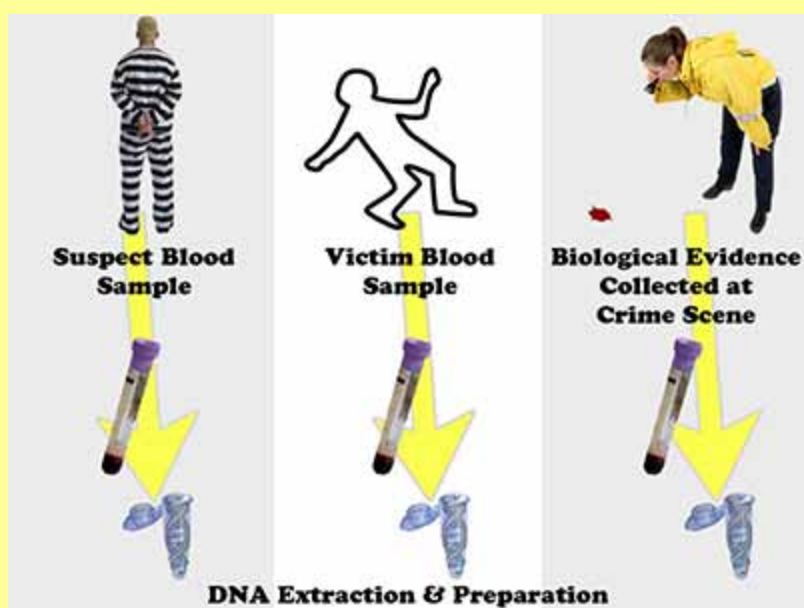
3 Repeats
(Box cars)

Allele
Dad



4 Repeats
(Box cars)

DNA BACKGROUND



- Forensic DNA analysts compare the genetic profile obtained from crime scene evidence to the profile from a known individual (e.g., suspect, victim).
- If the DNA profiles from the evidentiary and known samples are the same at each locus, laboratory analysts can provide a determination of the statistical significance of the evidence. In some cases, no conclusive interpretation can be made.

Other Types of DNA Analysis

Touch DNA

- **Definition: Limited casual contact by individual with a surface or material. (e.g. cigarette lighters, keys, door handles, gun grips, triggers, steering wheel, etc.)**
- **Elimination Standards are necessary.**

Other Types of DNA Analysis

Y-STR's

Inherited paternally—
Y Chromosome

Need same amount of DNA as with
other nuclear testing (Not for low
level samples like mito)

Useful when there is a male/ female
mixture with significantly more
female DNA present than male

Other Types of DNA Analysis

Mitochondrial DNA

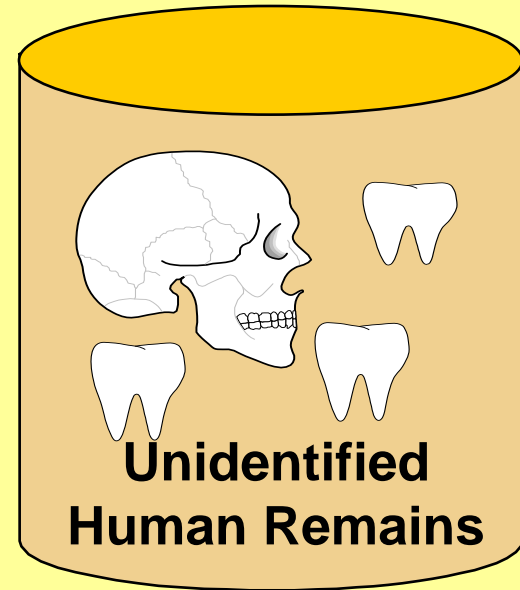
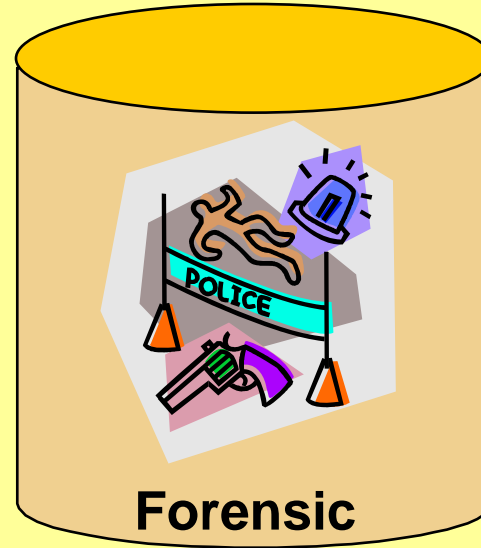
- Not Nuclear
- Inherited maternally
- More per cell, so often useful with unidentified remains, hairs with no root tissue, etc. (Low level samples)

CODIS **(Combined DNA Index System)**

CODIS blends DNA forensic science and computer technology into an effective tool for solving crimes. This tool enables state and local law enforcement, crime laboratories to exchange and compare DNA profiles electronically, thereby linking crimes to each other and to convicted offenders.

- The four primary functions of the current CODIS software are:
- DNA profile entry and management: deals with the database DNA profiles.
- Searching: allows a search of database DNA profiles.
- Match management: manages search results. For example, it allows a laboratory to record and distinguish whether a particular match is an offender hit or a forensic hit, and whether the match is within or outside of the state.
- Statistical calculations: enables laboratory personnel to calculate profile statistics, based on the laboratory's or FBI's population frequency data .

CODIS Indices



CODIS **(Combined DNA Index System)**

Does not store :

**criminal history information, DOB,
Case related information, ss#'s**

Matches made in the forensic index can link crimes together, possibly identifying serial offenders

police can coordinate separate investigations and share leads

Matches made between the forensic and offender indexes ultimately provide the investigator(s) with a potential suspect.

CODIS

- 1990 – FBI began a pilot project called CODIS creating software that enables Federal, State and local labs to compare DNA profiles
 - 14 pilot labs (state and local) received the CODIS software
- 1995 - Maryland received the CODIS software
- 1998 - Maryland's 1st CODIS hit
 - linked 2 PG County sexual assaults
- 1999 – FBI announces NDIS
- 2000 – Maryland's 1st National Hit
 - Anne Arundel County PD rape case hit to an Illinois Offender
- 2001 – Maryland's 1st offender hit
 - Anne Arundel County sexual assault

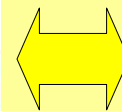
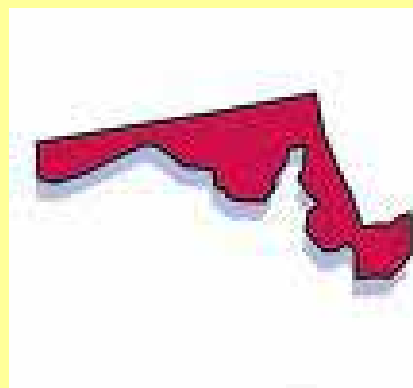
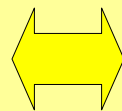
(The DNA Identification Act of 1994 formalized the FBI's authority to establish a national DNA index for law enforcement purposes.)

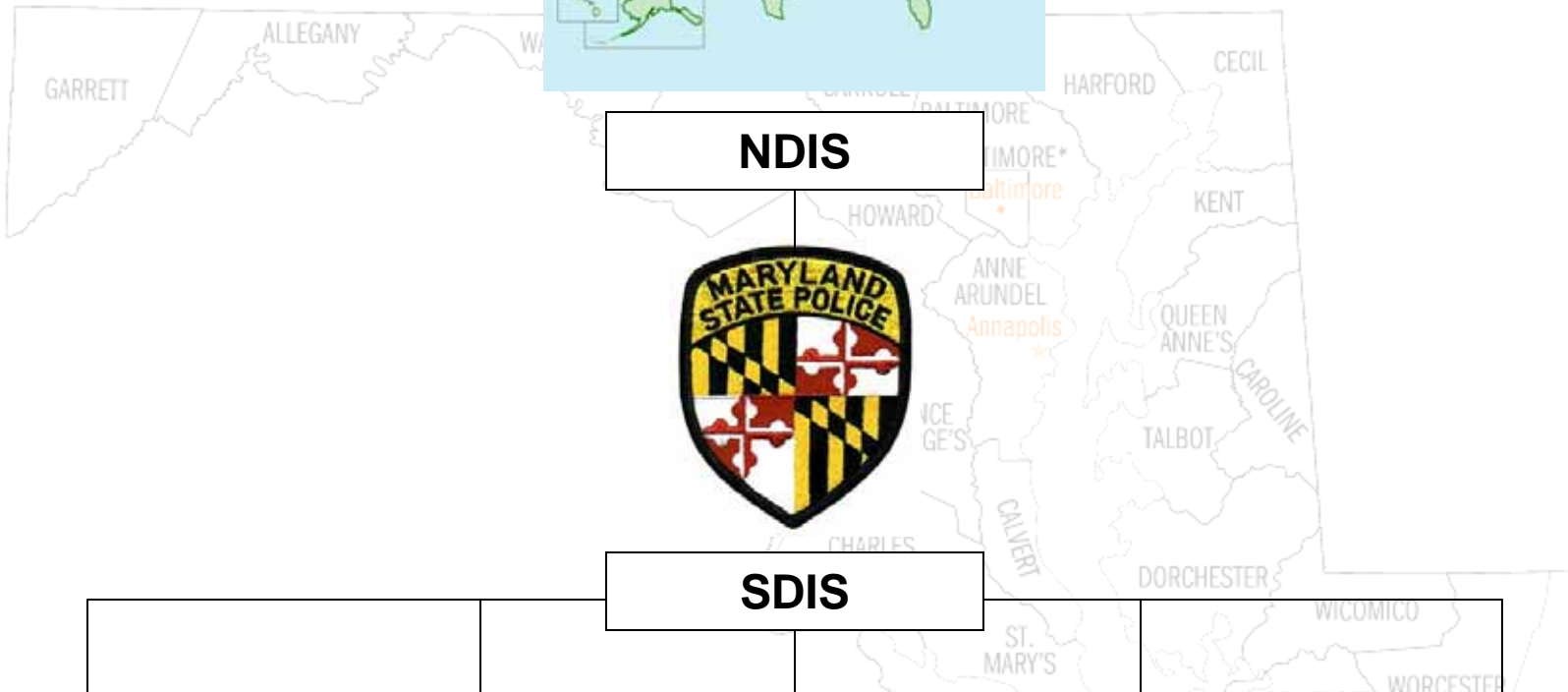
CODIS

- **over 170 public law enforcement laboratories participate in NDIS across the United States.**
- **Internationally, more than 40 law enforcement laboratories in over 25 countries use the CODIS software for their own database initiatives.**

CODIS

- **13 core loci** (D8S1179, D21S11, D7S820, CSF1PO, D3S1358, TH01, D13S317, D16S539, vWA, TPOX, D18S51, D5S818, and FGA)
- **Can compare data from lab to lab**
- **Can compare data internationally**
 - Interpol





NDIS



SDIS



LDIS

NDIS

National DNA Index System (NDIS)

Operated by the FBI

maintains and stores accepted DNA profiles from casework, arrestee's and convicted offender's

Data submitted from each state is searched against each other

potential matches are returned to the corresponding lab

victim's and exclusionary samples are not allowed
suspects are allowed (Maryland's does not submit suspect's profiles to NDIS)

SDIS

- State DNA Index System
 - Processes and enters arrestee and convicted offender samples
 - Liaison between the local labs and NDIS
 - Maintains and stores accepted DNA profiles from the local labs and the state lab
 - Searches the local labs and state data against each other
 - Potential matches are returned back to the corresponding lab
 - Suspect's are allowed at SDIS (Maryland)
 - Victim's and exclusionary samples are not allowed

LDIS

- Local DNA Index System
- Submits acceptable DNA profiles to SDIS
- suspect's are/not allowed (depends on each jurisdiction)
- Victim's and exclusionary samples are/are not allowed (depends on law)
- Searches against itself (Baltimore City against Baltimore City)

CODIS ACCEPTABILITY

- **DOCUMENTATION that a crime was committed** (prior consensual partner, detailed scenario from investigator)
- **Profile developed from a putative perpetrator** (BOTH solved and unsolved cases are entered into CODIS)
- **Was the item seized by law enforcement from the suspect's person OR in the possession of the suspect when collected by law enforcement** (not entered into CODIS)
- **Cannot violate 4x4 rule** (max of 4 alleles at up to 4 loci, all other loci must have no more than 2 alleles)

Offender/Forensic Profiles at NDIS

	2000	2001	2002	2003	2004	2005
Offender profiles	460,365	750,929	1,247,163	1,493,536	2,038,514	2,826,505
Forensic profiles	22,484	27,897	46,177	70,931	93,956	126,315

	2006	2007	2008
Offender profiles	3,977,433	5,372,773	6,539,919
Forensic profiles	160,582	203,401	248,943

NDIS

**CODIS has produced over
83,800 hits assisting in more
than 83,000 investigations**

PROFILES in SDIS

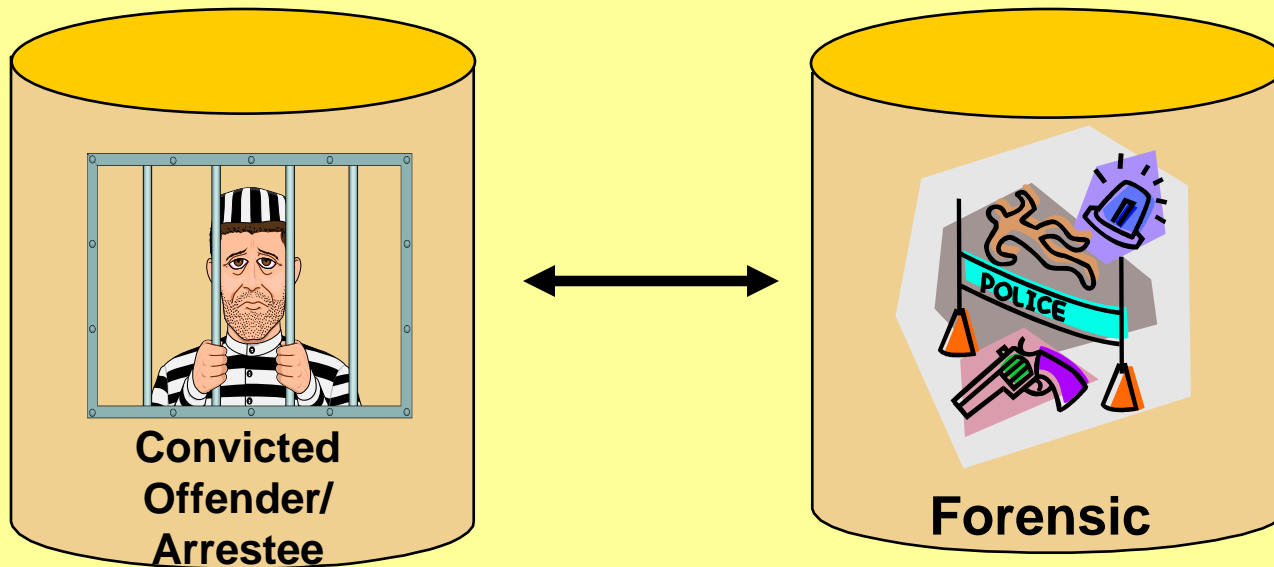
(6-1-09)

- **Convicted Offender = >78,000**
- **Arrestees = >800**
- **Forensic = >5,000**

Searches

- **NDIS**
 - Weekly (Monday)
- **SDIS**
 - Weekly (day varies)
- **Missing Persons (NDIS)**
 - monthly

BASIC SEARCH



Maryland's Offender Legislation

- **Maryland's Statewide DNA Database was established in 1994 when a law was passed requiring all convicted sex offenders to submit DNA samples.**
- **In 1999 - Maryland's law was expanded to include convicted offenders of violent crimes.**
- **In 2002, the law was again expanded to all felony convictions, including some misdemeanor crimes.**

Year	Qualifying Offense
10/94 - 10/99	Rape of any degree Any sexual offense Sexual child abuse (Does not include any attempts of these crimes)
10/99 - 10/02	Sexual offenses listed above PLUS Murder 1st degree assault Robbery Any attempts of any of these crimes
10/02 – 12/31/08	All felonies 4th degree burglary B & E of a motor vehicle
1/1/09 (arrestee)	Crimes of Violence 1st degree burglary 2nd degree burglary 3rd degree burglary Any attempts of any of these crimes

21 States + Federal now have arrestee legislation

Alabama

Alaska

Arizona

Arkansas

California

Colorado

Florida
(7/1/09)

Kansas

Louisiana

Maryland

Michigan
(7/1/09)

Minnesota

New Mexico

North
Dakota
(7/31/09)

Oklahoma

South
Carolina

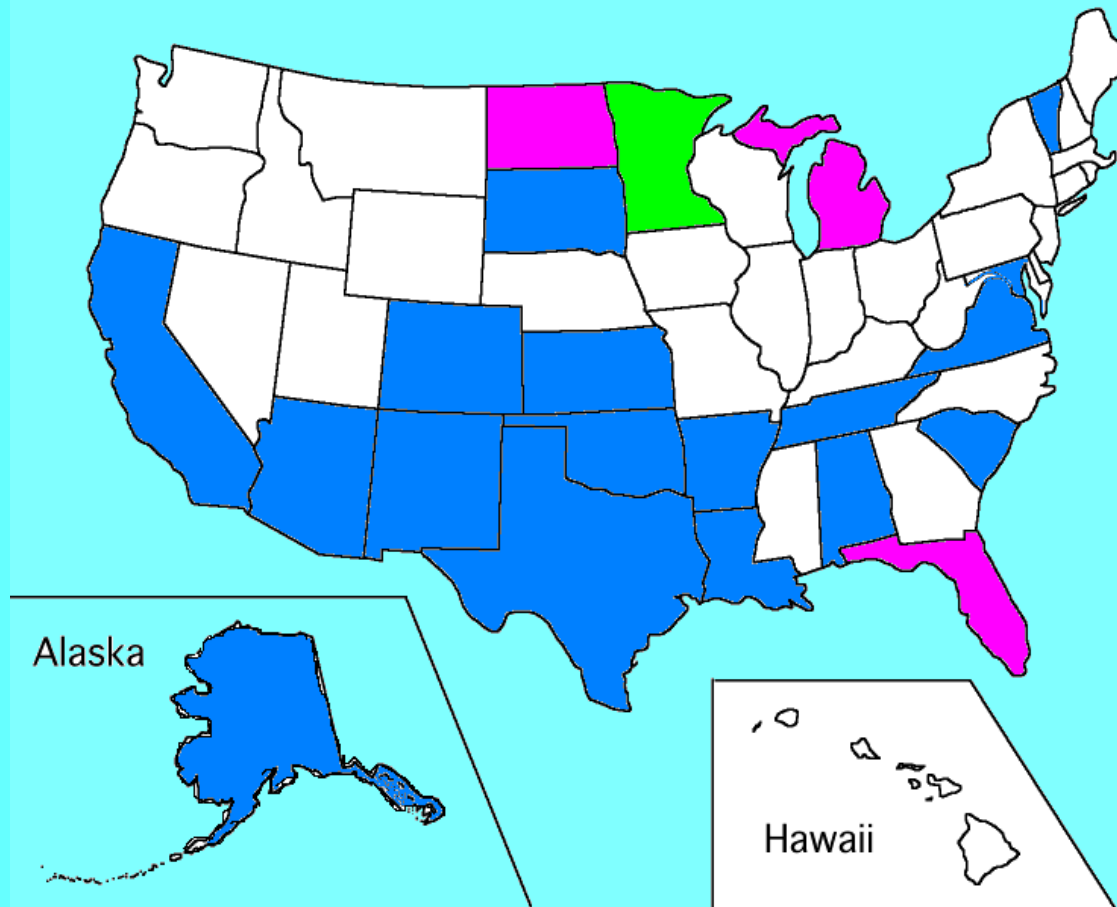
South
Dakota

Tennessee

Texas

Vermont

Virginia



Federal arrestees (1/15/09)

Arrestee Laws

- **Minnesota – not collecting, unconstitutional**
- **Oklahoma – collects from aliens unlawfully present under Federal Immigration Law**
- **Florida – signed; start collecting in 2011, every 2 years additional felony offenses are added until 2019**

Maryland's Arrestee Legislation

- **Effective January 1, 2009**
- **Arraignment date is analysis trigger date**
- **Automatic expungement**

Qualifying Offense under Maryland's Arrestee Law

Arson

Arson 1st °

Kidnapping

Manslaughter

Maiming (1st ° assault)

Murder

Rape

Robbery

Carjacking

1st ° sexual offense

2nd ° sexual offense

Use of handgun in commission of a crime

Continuing course of conduct w/ child

1st ° burglary

2nd ° burglary

3rd ° burglary

Any attempts of these

Maryland's Arrestee Legislation

- The Statewide DNA data base system shall NOT be used for the purpose of identification of an offender in connection with a crime for which the offender may be a biological relative of the individual from whom the DNA arrestee or convicted offender sample was acquired (familial searching)



- **Samples collected for purposes of the database (offender/arrestee) CANNOT be used as a standard for a case**
- **If a “hit” occurs then a new standard from that person will need to be collected. The hit report will aid in obtaining the probable cause to obtain the standard**

CUMULATIVE CODIS HITS for MARYLAND

(6-1-09)

Total Hits – 1,404

Forensic Hits (case to case) – 362

Offender Hits State – 767

Offender Hits National – 270

Investigations Aided – 1,463

Arrestee Hits State - 5

Baltimore Sun June 12, 2009

Police charge sex assault suspect in separate rape cases

Halethorpe man linked to city attacks through DNA collected in county arrest
By Peter Hermann | peter.hermann@baltsun.com

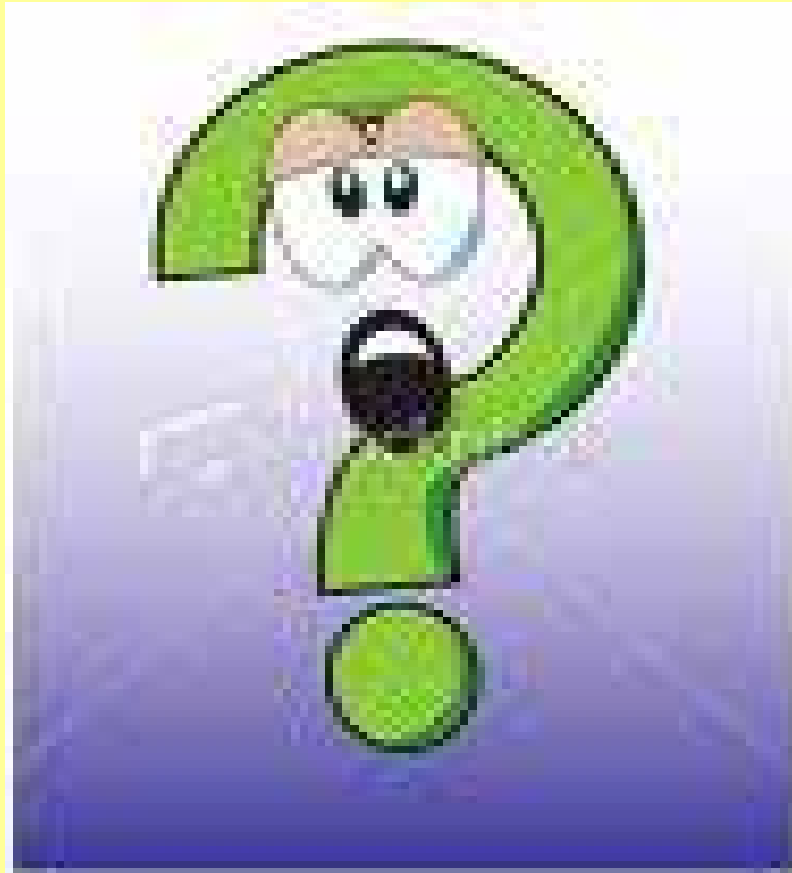
3:11 PM EDT, June 11, 2009

A 32-year-old man who **Baltimore County** police accused in February of sexually assaulting two young girls now faces additional charges in Baltimore after police arrested him Thursday morning in connection with the **abduction and rape of two teenagers** in separate attacks in 2000 and 2004.

Authorities said they linked the suspect to the earlier rapes through DNA collected from the man when he was arrested in the county four months ago. He had posted bail pending his August trial, but city police said they re-arrested him at his house in [Halethorpe](#).

Police identified the suspect as Gregory Leslie Brown of the 2400 block of Tionesta Road, just south of the city line, and said they had charged him with two counts of rape and two counts of false imprisonment.

The case is one of the first under an expanded Maryland law that took effect in January that requires law enforcement to collect DNA from individuals charged with committing or attempting to commit violent crimes. In the past, authorities could only collect DNA after someone had been convicted.



mgroves@mdsp.org

443-357-1300