

**“ COLLECT THAT SHIRT AND  
SUBMIT IT TO THE DNA  
LAB”**

# **Homicide Conference**

## **July 14-15**

Ken Morrow  
Palm Beach County Sheriff's Office  
Forensic Sciences Division  
Section Manager

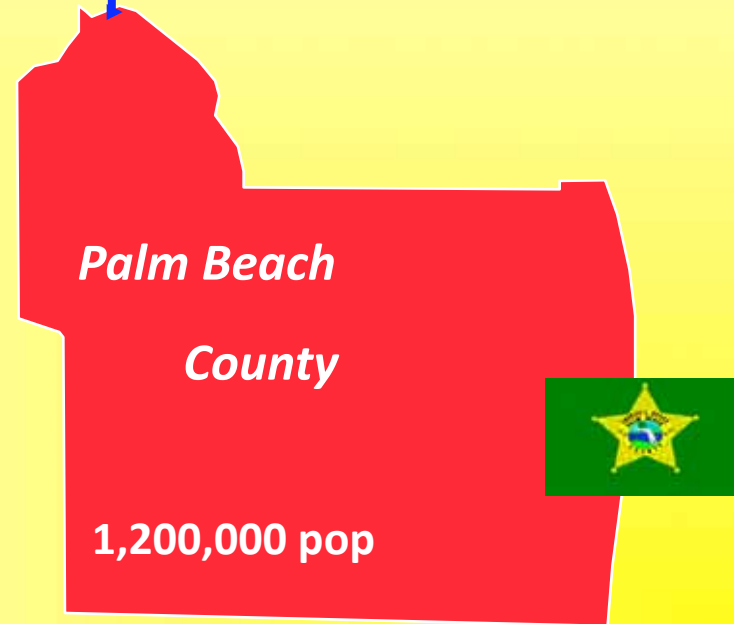




We Are Here in Tampa, FL

<b>2008 Homicides</b>	<b>67</b>
<b>2009 Homicides to Date</b>	<b>26</b>

- ✓ Largest county in Florida
- ✓ 28 local police agencies
- ✓ Palm Beach County SO  
4,200 employees  
100 in Forensic Sciences Division
- ✓ Medical Examiners Office
- ✓ Local FBI, DEA, ATF agency
- ✓ Universities and area schools



# PBSO ORGANIZATIONAL CHART

Sheriff



Colonel



Major

Strategic Operations



## Forensic Sciences Division



### CRIME LABORATORY

**Chief Scientific Officer**

**Forensic Biology Unit Manager**

**Drug Chemistry**

**Toxicology**

**Firearms**

### TECHNICAL SERVICES

**Section Manager (me)**

**Crime Scene**

**Latent Print/10 Print**

**Evidence**

**Impound Lot**

**Property Evidence**

**Crime Lab Evidence**

**Photo Lab**



Currently Nationally Accredited; Future: International Accreditation

The American Society of Crime Laboratory Directors



Laboratory Accreditation Board

declares to all Advocates of Truth, Justice and the Law that the management, personnel, procedures, and facilities of the

Palm Beach County Sheriff's Office Technical Services Division

located at 3228 Gun Club Road West Palm Beach, Florida

have been found to meet or exceed the standards and requirements of the 2005 version of the ASCLD/LAB Accreditation Manual, and therefore the Board of Directors grants this

CERTIFICATE OF ACCREDITATION

in the disciplines of

Controlled Substances, Toxicology, Biology, Latent Prints Firearms/Toolmarks (firearms only) and Crime Scene

Robert B. Stacy, Director

Robert M. Keaton, Executive Director

Taney Cheaney, Program Manager



Certificate number

85

effective date

7th day of December, 2006

expires on the

6th day of December, 2011

# Crime Scene

- Staff

- Total number of staff: 13 CSI's
- Two managers for 8 hour shifts
  - Day Shift
  - Night shift
- Hours of operation:
  - 6-4
  - 4-2
  - 8-6





# Crime Scene Cont'd



- On Call
  - Section Manager (me)
    - Police Involved Shooting
    - Police Death(s)
    - In-Custody Death
    - Complex Homicides
      - » More than One Victim
      - » Extended Crime Scene Area
      - » High Profile Homicide (Wendy's )
  - A CSI Manager will attend a crime scene when warranted
- CSI Requirements
  - Certification within 3 years of employment
  - Managers: Certification and Bachelors in the Sciences or related-field
  - Section Manager: Masters degree, prior Law Enforcement experience, Managerial experience



- 13 CSI's
- 2 Supervisors
- 1 Evidence Processing Tech

• Large Area Serviced  
Approximately 1.2mil residents.

• Almost 2500 square miles

• Jupiter to Boca Raton

• East coast to  
Lake Okeechobee

• Death Scene Investigation  
• 25%

• Robbery/Burglary

• Sexual assaults

• Shooting scenes

• Elderly and child abuse

• Search Warrants

• Reports/Testimony







# Dispatch Arrival





- Document
- Collect
- Process
- Preserve

The four basic  
functions  
of a CSI





# Document



1. Video

2. Photographs

3. Notes

4. Diagram

5. Measurements



# Evolution of the Crime Scene Unit

- Prior to mid-1990's
  - CSI's were sworn personnel
  - Unit reported to Detective Bureau
- Mid-1990's
  - Transition to civilian CSI
    - Cost savings
      - Lower salaries
      - Lower pension
      - Emphasis of technical skills not sworn
      - No longer stepping stone for sworn personnel

## **Unit make-up 1994:**

**4 Sergeants**  
**4 Sworn CSI**  
**4 Civilian CSI**  
**3 Shifts 24/7**

## **Unit Make-up 2001**

**1 Section Manager, Civilian**  
**1 CSI Manager, Civilian**  
**9 CSI, all Civilian**  
**3 Shifts 24/7**



# Homicide Detective Interactions

- Who's crime scene is it?
- Who's making the decisions?
- Who's at the scene?
  - Crime Scene Personnel
  - Deputies, First Responder
  - Detectives



# Homicide Detective Interactions

- **MEO**
- **Paramedics**
- **State Attorney's Office**
- **Internal Affairs**
- **PBA Attorney**
- **Chain-of-command:**
  - Sgt > Lt > Captains > Major > **Colonel** > **Sheriff**
    - » **Why are they at the scene?**
      1. Media
      2. Provide additional resources (Marine unit, Other LEA, Air)
  - » **What is the Section Manager's Role?**
    - » **Liaison between CSI and LE**
    - » **Facilitate any additional resources (Firearms/Latents/DNA)**
    - » **Allow CSI to process scene in a logical manner**



# CSI: Homicide Detective Issues

**So... whose scene is it?**

**CSI: processing for evidentiary purposes**

**Homicide Detectives: developing investigative leads**

- Example of “liaison” duties
  - Prevent Higher Command giving instructions to individual CSI’s; conflicting directions
    - CSI processing the living room, do the victim
  - Remove any unnecessary personnel from the Crime Scene
  - LE needs process accelerated
    - Walk-through in a police shooting, drop current processing and step-back for walk-through





# What Works?

- Controlling the scene
  - Inner and outer perimeter
- Ultimate authority at a Crime Scene:
  - Captain
- Compromise works best
  - Need to respect the CSI
    - Technical Abilities
    - Maintaining Accreditation Standards
      - If conflicting, CSI will have Captain approve deviation from protocol
- Before the scene is released
  - Communication Briefing:
    - CSI
    - LEO



# Improving Crime Scene Processing

- New Technologies
- Leica - Advantages
  - 3-D survey quality computer diagram.
  - **It documents everything in the scene, items that don't initially appear relevant to the investigation you have captured and can go back to**
  - It generates a 360 degree photographic image
  - Virtual Creation
  - Creates millions of points for measurements instead of the few handful of measurements most pertinent items within the scene





- Leica –Limitations

- Expensive (\$160,000)

- Adds 4 – 5 hours of time at a crime scene**

- Has a learning curve – 60 hours of training for competency

- 120 hours of training for proficiency

- Somewhat difficult to transport (heavy & bulky)



# IMPROVING CRIME SCENE EFFICIENCY



← 30 FT →

- ❖ Homeland Security Funds
- ❖ LDV
- ❖ Burlington, WI
- ❖ No CCO
- ❖ Reserve Deputies on call

External 360 lighting System



Awning for external set-up







**FRU**



**Rear entrance**



**Interior**

Fax machine

Locked Cabinets

Countertops





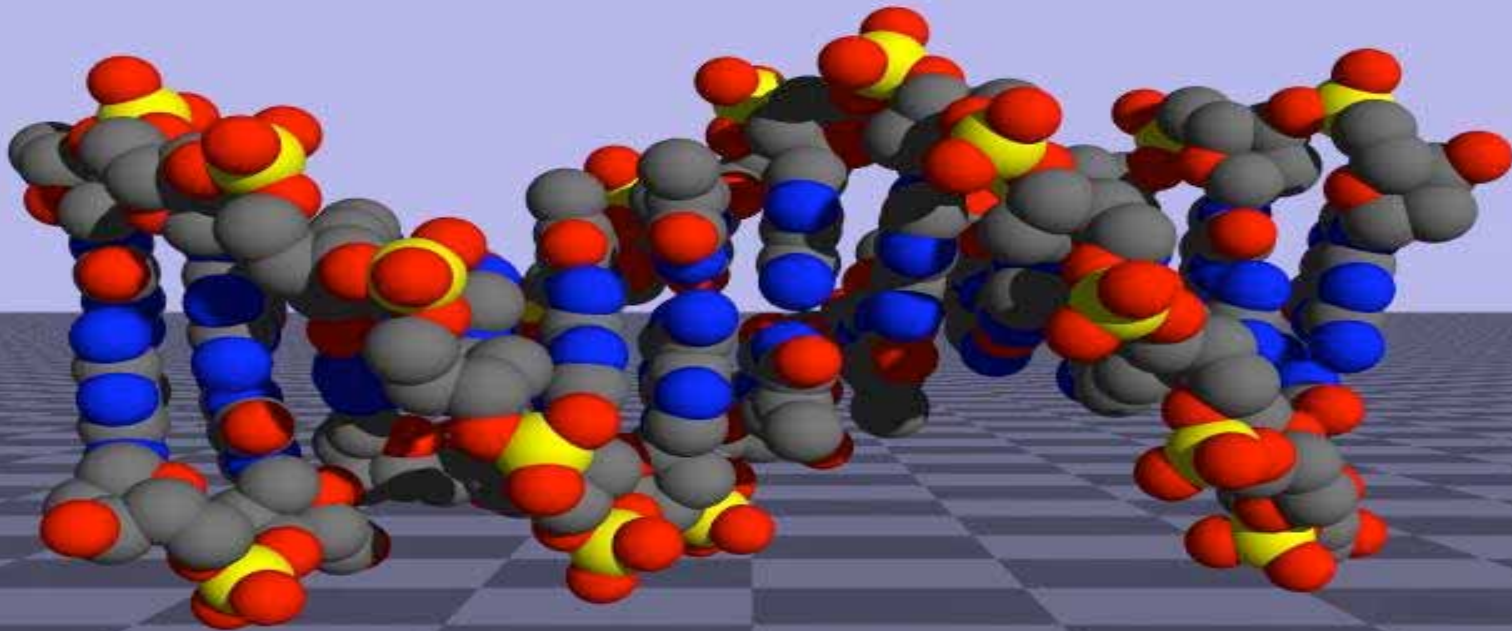
Got Chalk?



# Collect that Shirt And Get It To The DNA Lab

## 2009 Homicide Conference

### July 14-15, 2009



*Cecelia A. Crouse Ph.D.*  
*Chief Scientific Officer*

*Palm Beach County Sheriff's Office*  
*Forensic Biology Unit*



CRIME SCENE - DO NOT ENTER

# BASIC PRINCIPLES OF DNA :

- **Case facts: Sexual Assault**
  - Victim 17 years old
  - Jogging in local park at night
  - Assailant tackles her, drags her into the bushes
    - Strangles until unconscious, she dies later
    - Vaginally assaulted
    - Found by another jogger a short time after the assault
- Semen on the Vaginal swabs
- Called Detective for a standard from the suspect
- Standard was submitted and I signed it out for analysis

Liquid Semen Submitted



## BEFORE CSI:

Go ahead and take a swab of my mouth,  
I left blood at the scene... not spit...



## AFTER CSI

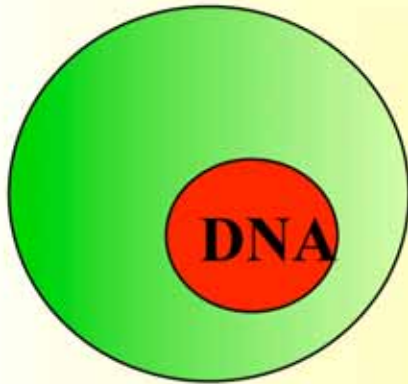
Do you have a search warrant?



Why doesn't it matter where the standard comes from???

# THE BASICS:

Where did your DNA come from?

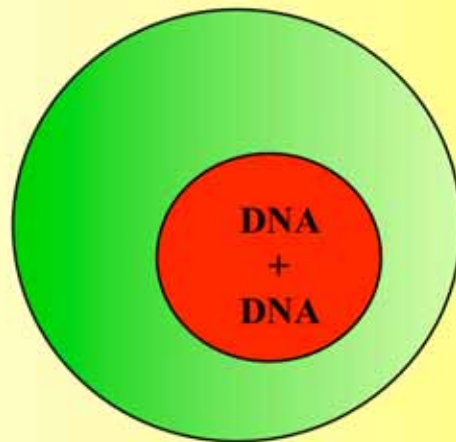


**1 EGG  
(MOM)**

+



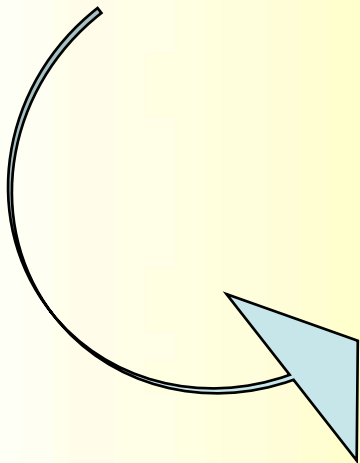
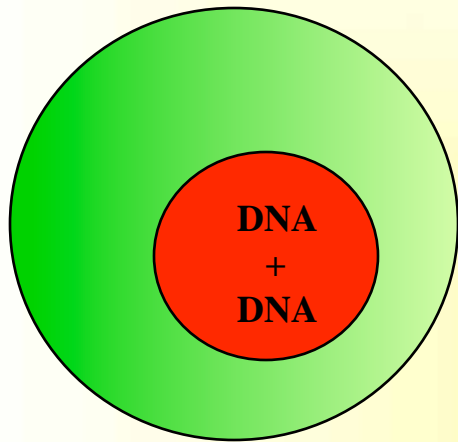
**1 Sperm  
(Dad)**



= GENETIC RECIPE  
FOR AN ENTIRE  
ORGANISM



# DNA CONTENT IN ONE HUMAN CELL

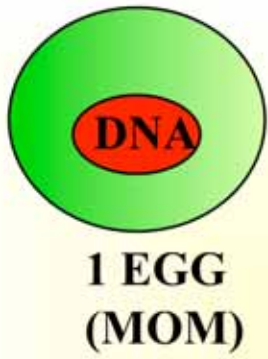


= X = Female

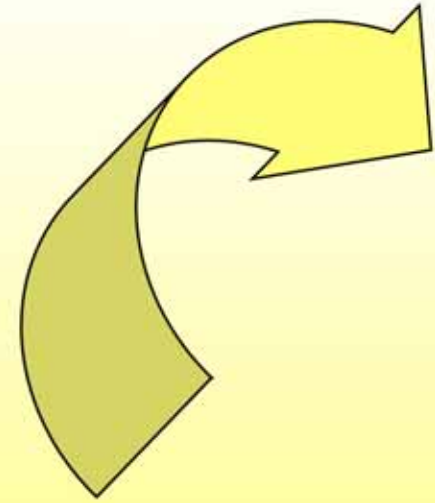
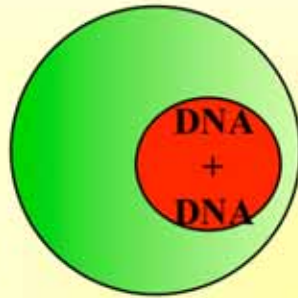
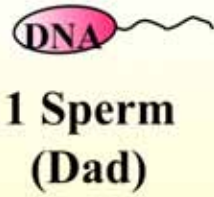
= Y = Male



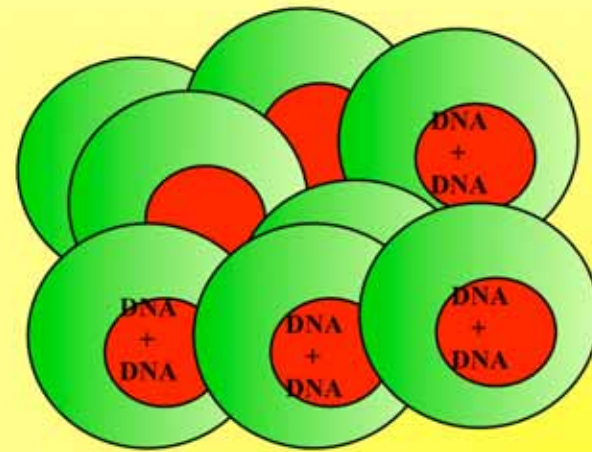
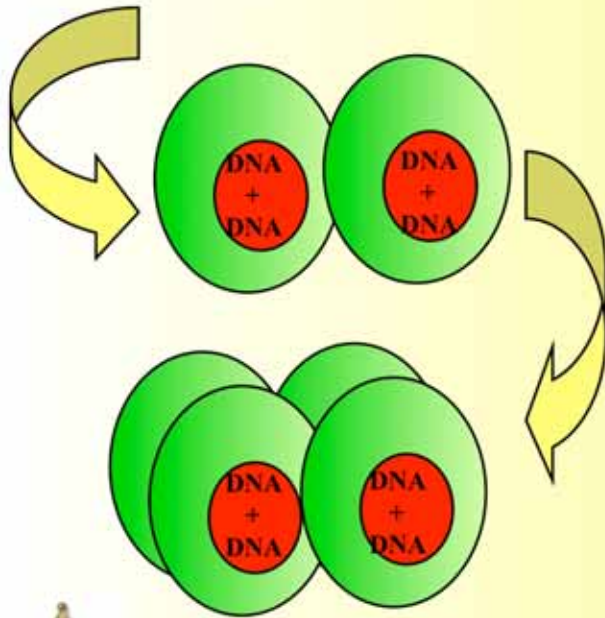




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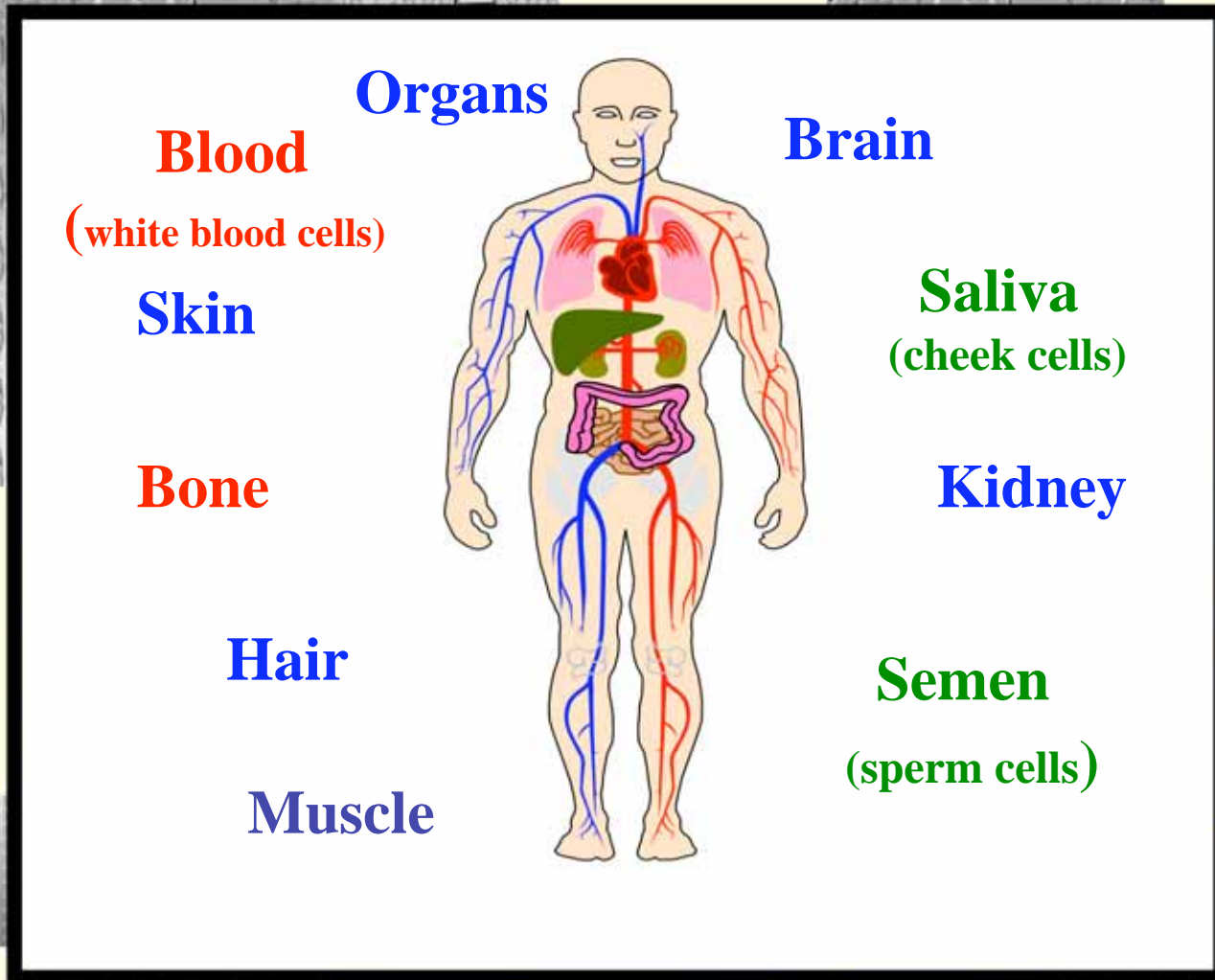
**GENETIC RECIPE  
FOR AN ENTIRE  
HUMAN BEING**







# A DNA PROFILE MAY BE OBTAINED FROM ANY NUCLEATED CELL IN OUR BODY



ACGATCGACTACGACTAGCTACGACTACGATCAGCATCGACTACGTCGCTTTTTTCGCTCGGGGGGCTAGATCGCTCGATCG  
CGCTCGATACGTACGCTCGACGATAACACACGACGCTCCTCCCCCGCTCGCTCGAAAAATCGCTAGCTAGCTTAGCTAG  
ACGATCGATATATAGCGCGCTATATATATATACGCGCGCATCCGCCTGCTGATCGCTAGATATATAGCTAGCTAGCATCGA

**DNA works because the 6 billion  
“rungs of the ladder” are not in  
identical order**

ACGATCGACTACGACTAGCTACGACTACGATCAGCATCGACTACGTCGCTTTTTTCGCTCGGGGGGCTAGATCGCTCGATCG  
CGCTCGATACGTACGCTCGACGATAACACACGACGCTCCTCCCCCGCTCGCTCGAAAAATCGCTAGCTAGCTTAGCTAG  
ACGATCGATATATAGCGCGCTATATATATATACGCGCGCATCCGCCTGCTGATCGCTAGATATATAGCTAGCTAGCATCGA

**= Polymorphism**

ACGATCGACTACGACTAGCTACGACTACGATCAGCATCGACTACGTCGCTTTTTTCGCTCGGGGGGCTAGATCGCTCGATCG  
CGCTCGATACGTACGCTCGACGATAACACACGACGCTCCTCCCCCGCTCGCTCGAAAAATCGCTAGCTAGCTTAGCTAG  
ACGATCGATATATAGCGCGCTATATATATATACGCGCGCATCCGCCTGCTGATCGCTAGATATATAGCTAGCTAGCATCGA

**= Uniqueness**

ACGATCGACTACGACTAGCTACGACTACGATCAGCATCGACTACGTCGCTTTTTTCGCTCGGGGGGCTAGATCGCTCGATCG  
CGCTCGATACGTACGCTCGACGATAACACACGACGCTCCTCCCCCGCTCGCTCGAAAAATCGCTAGCTAGCTTAGCTAG  
ACGATCGATATATAGCGCGCTATATATATATACGCGCGCATCCGCCTGCTGATCGCTAGATATATAGCTAGCTAGCATCGA

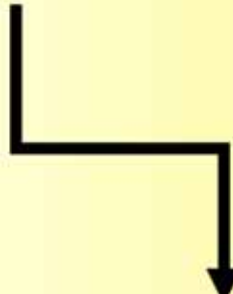


# Evidence Handling

**Evidence Custodian**

Agency #: 96-123456  
Name: Jane Doe  
Date 9/5/96  
items: pants, shirt

Rev BY: Det Johnson  
COC: Cecelia Crouse  
Signatures



**DNA Analyst**



*Standards*



**Find stains**



**FROM CRIME SCENE  
TO...**

**SCREENING  
EVIDENCE  
FOR  
BIOLOGICAL  
MATERIAL**

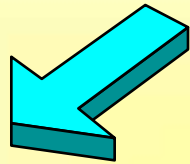
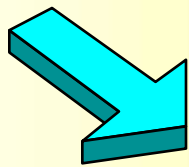




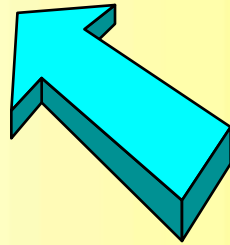
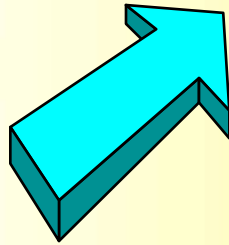
# Obtaining Evidence Samples

Vaginal/Rectal/Oral

Panties



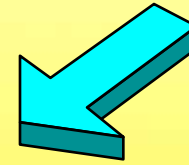
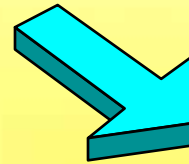
**SEMEN**



Furniture

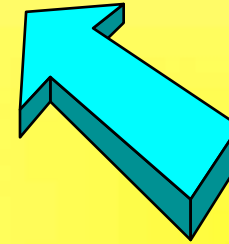
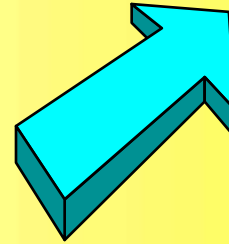
Weapons

Clothing



**BLOOD**

Carpet



Standards

Vehicles





Body Swabs

Nasal secretions

Toothbrush

Cars

Feces



Envelopes



Fingernails

Vomit



Organs

Shoes

Hairs



Guns

Cups

Cigarette butts



Cool Samples





**Body Swabs**

**GUNS-touch**

**fingerprint**

**peach strudel**



**gum**



**Cocaine bricks**

**telephone receiver**

**Chicken sandwich**

**Ligatures**

***NOW...PRETTY MUCH YOU NAME IT:***



**PAP (Penile Access Portal)**

**chicken wing**

**bongs**

**contact lens from vacuum cleaner**

**urine in the snow**

**tape**

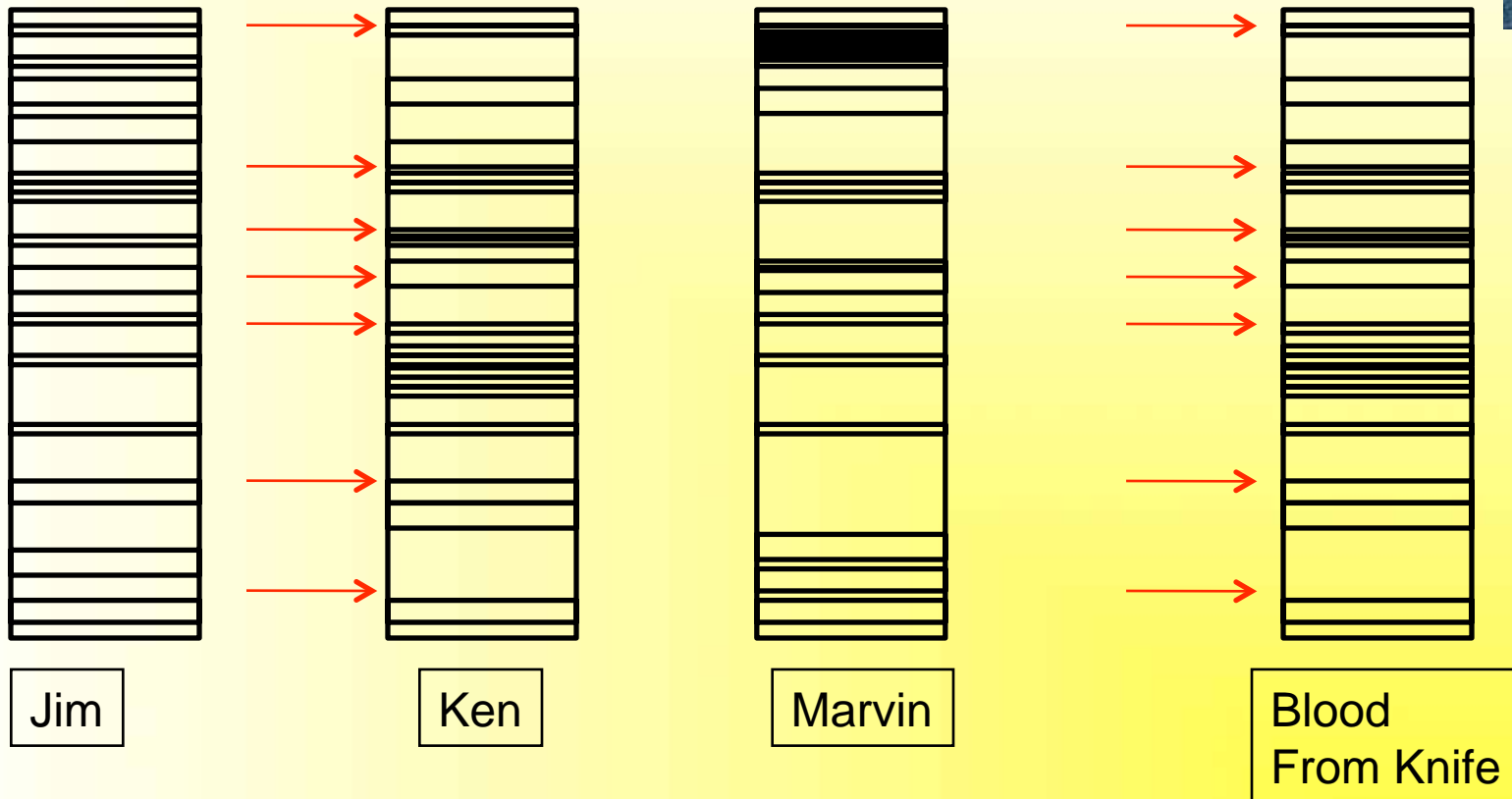


**wiener (BallPark)**





# Single source DNA Profiles....

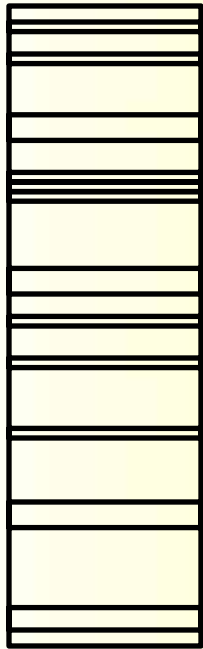


**Conclusion: Ken is included as a possible source of the DNA from the blood on the knife. Jim and Marvin are excluded.**

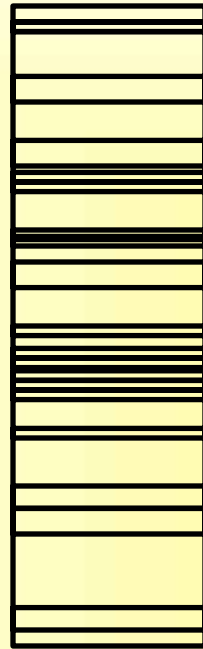




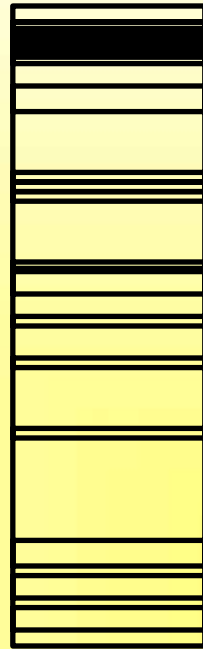
# Mixture DNA Profiles....



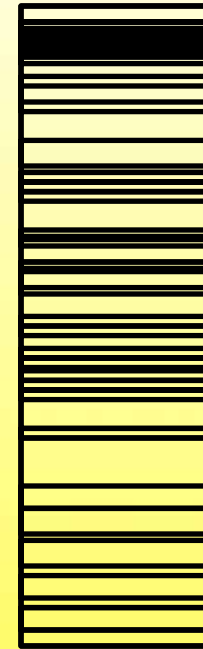
Jim



Ken



Marvin



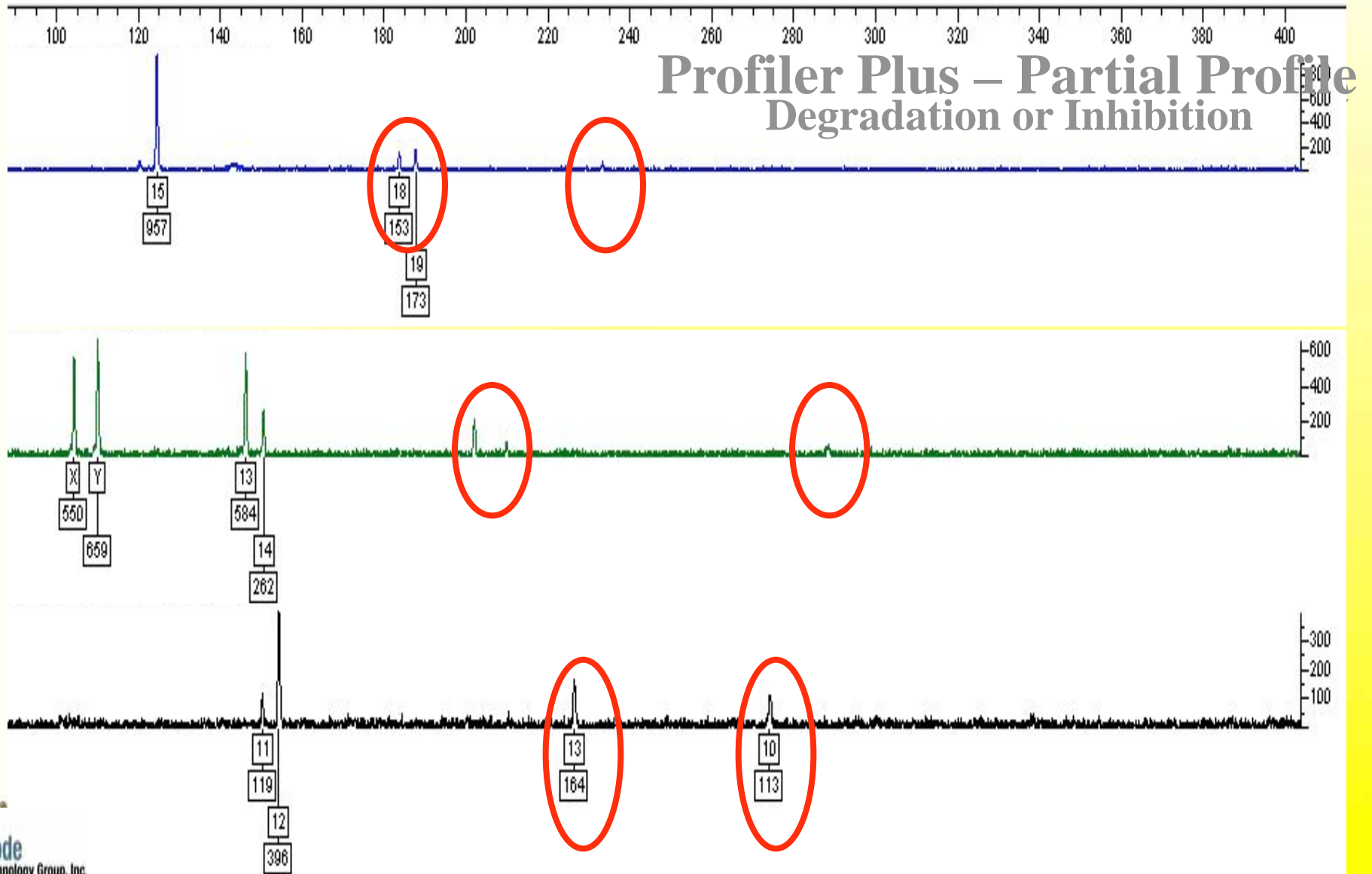
Blood  
From Floor=  
Mixture

**Conclusion: Depends...**



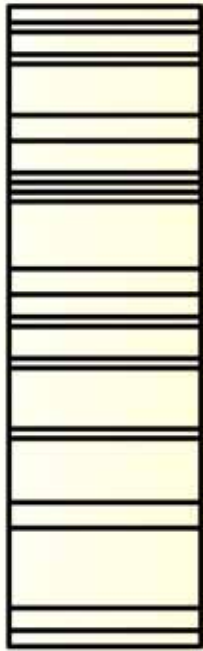
# World Trade Center – Phase I Summary

## Degraded Samples





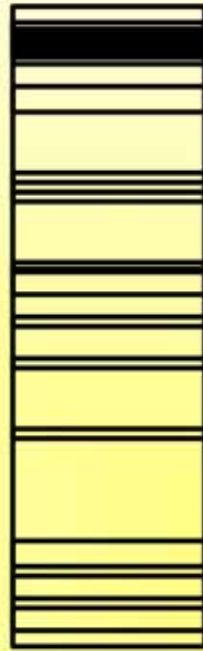
# Degraded DNA Profiles = Partial



Jim

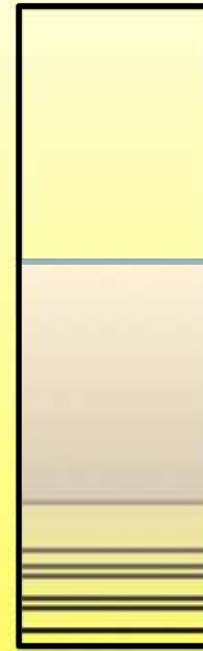


Ken



Marvin

?



Blood from a smear on the outside bumper of the car?



What are the most challenging types of evidence for the laboratory?

**TOUCH**

Mixtures   Degraded   Low Copy #



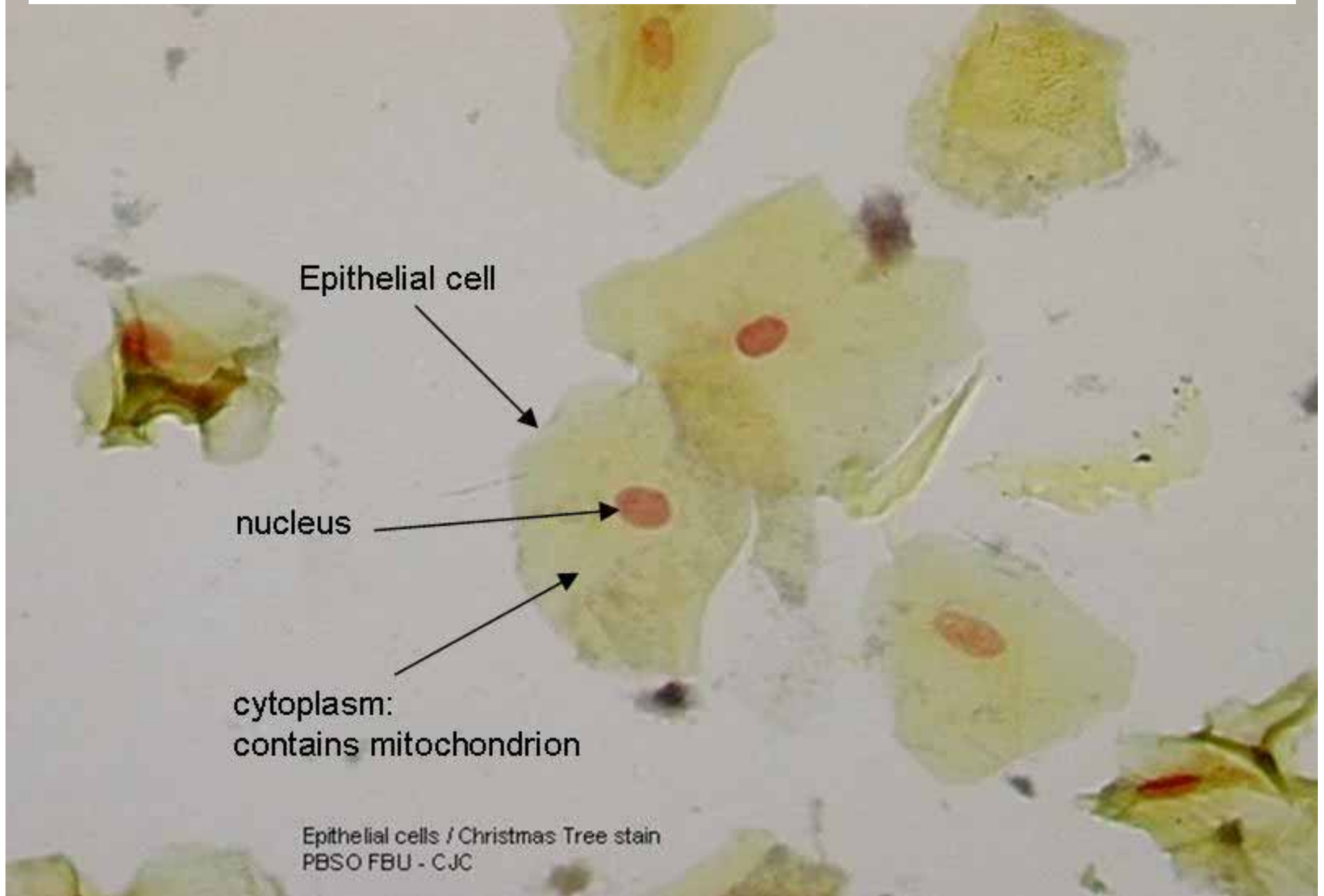
# TOUCH EVIDENCE:

## LCN = Low Copy Number

1. Obtaining a DNA profile from less than **16** cells. Tiny amounts of DNA collected
2. Need a MOON SUIT DNA lab: None in Florida
3. Very controversial
4. Any DNA profile resulting from a LCN analysis MAY NOT go into the National DNA database
5. NYC OCME: will do LCN for free



**Touch evidence = nearly every case, need about 125 cells...**



# CSI EFFECT AND TOUCH EVIDENCE

Homicide of an elderly couple at their convenience store:

We submitted the victim's wallet that was found on the front porch.

We know the perpetrator must have touched the wallet so we swabbed it in four places.

I know the video shows he was wearing gloves and we do not have the gloves

**BUT...**

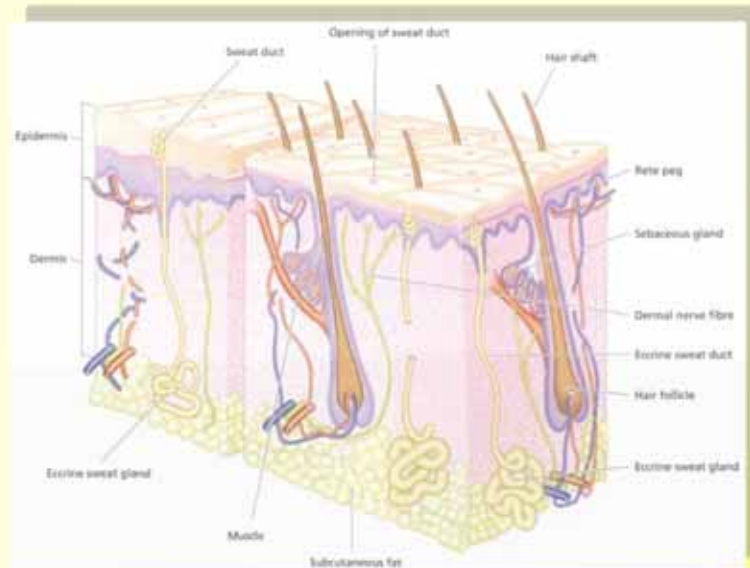
his DNA would be on the outside of his gloves when he originally put them on so when he touched the wallet, or he may have wiped his forehead with his gloves on then his DNA could have transferred to the wallet...



**Is this the ONLY evidence in the case????**



# The Anatomy of the Skin



- The skin is a complex organ –  
Largest organ of the human body
- Accounts for 15% of body weight



Considering a skin area average 3mm thick, it contains:

- containing 10 hair follicles,
- 100 sweat glands, and up to 2,500 sensory cells
- 3 meters of lymphatic and **blood capillaries** ,
- 12 meters of nerve fibres, etc.



# How many skin cells does it take to get a DNA profile?

**Approximately 6pg of DNA/cell**  
**Obtain full DNA profiles with 750pg**  
**= 125 cells**



**Corneocytes** are constantly replaced as they continuously slough off the surface of the skin in a process known as desquamation.



# Fun fact-Shedding Corneocytes

- In each year there are 365 days (except for leap year when there are 366 days).
- If we divide the number of days it takes to replace your skin cells (35) into the number of days in a year (365) you can see that the skin is replaced about 10 times.  $365/35 = 10.428$
- Take home message: change your sheets...often...

**QUESTION BECOMES: So if we mainly slough off dead cells, why can we get a DNA profile from “touch evidence”?**

1. Depends if a person is a good slougher
2. Depends how long they have handled the item:  
simple physics



PBSO HAS ZERO SUCCESS WITH  
SWABBING **SPENT** BULLET CASINGS AND  
OBTAINING A COMPARATIVE DNA PROFILE



=IF DNA IS PRESENT =LCN?





**July 8th, 2005:**  
Elderly Female victim (82) is  
murdered in her home



Rag



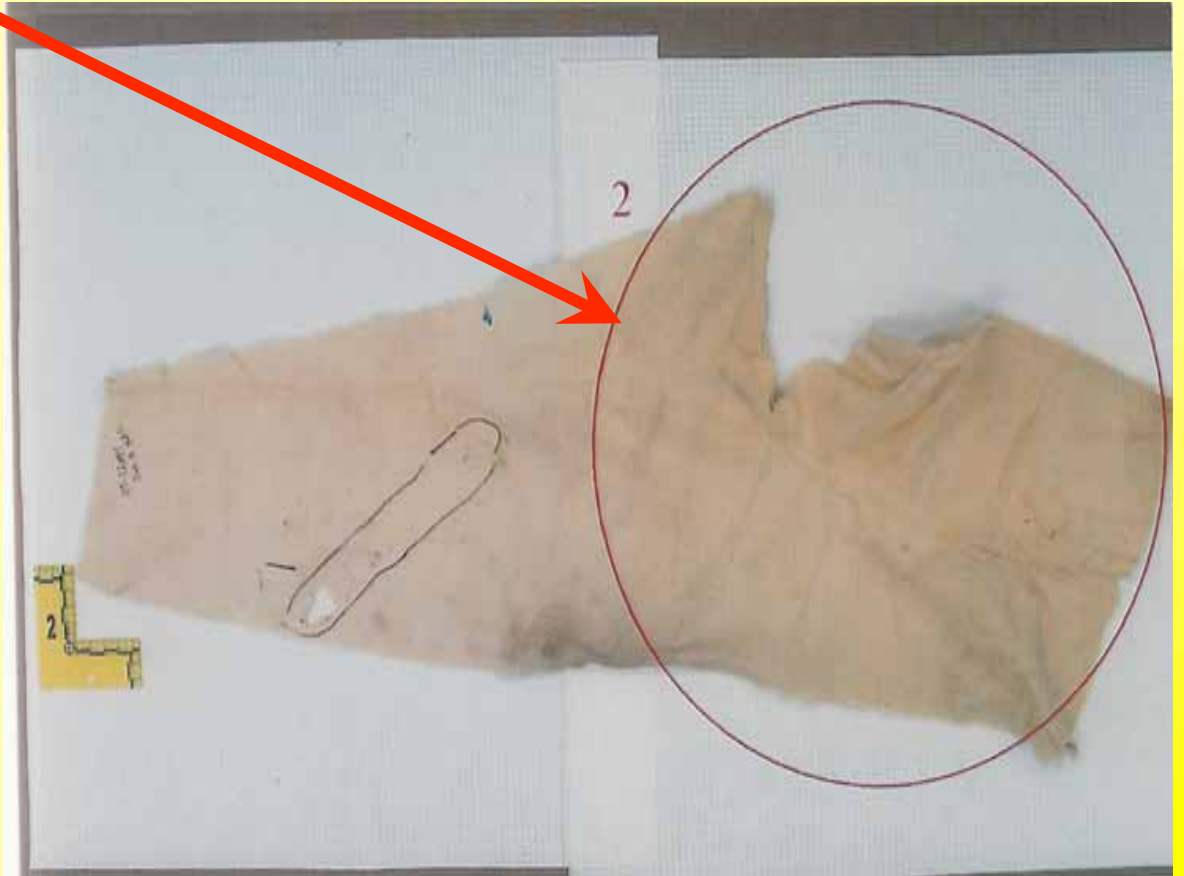
VASE

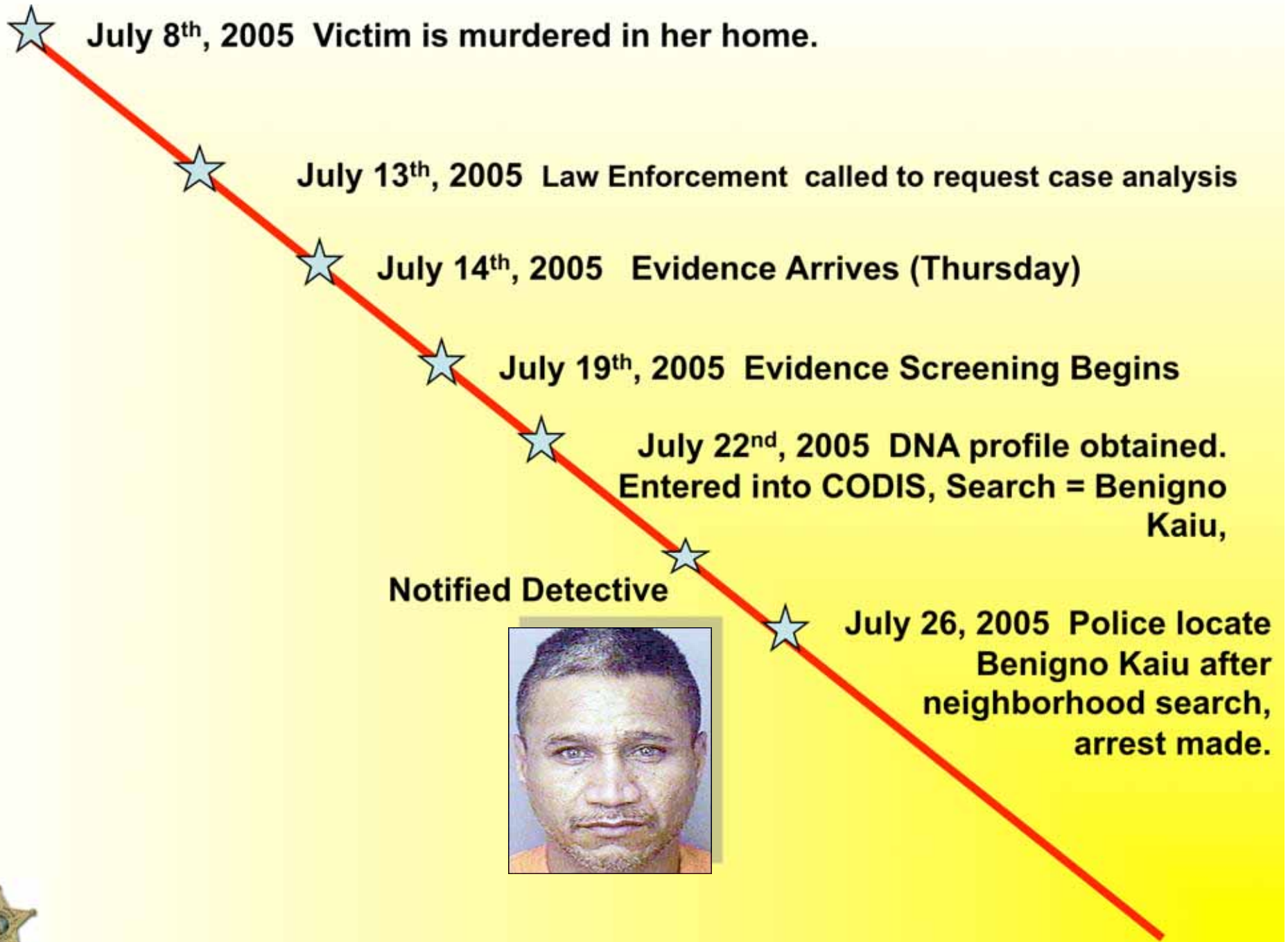


Evidence found at the scene



# Cloth found at the scene





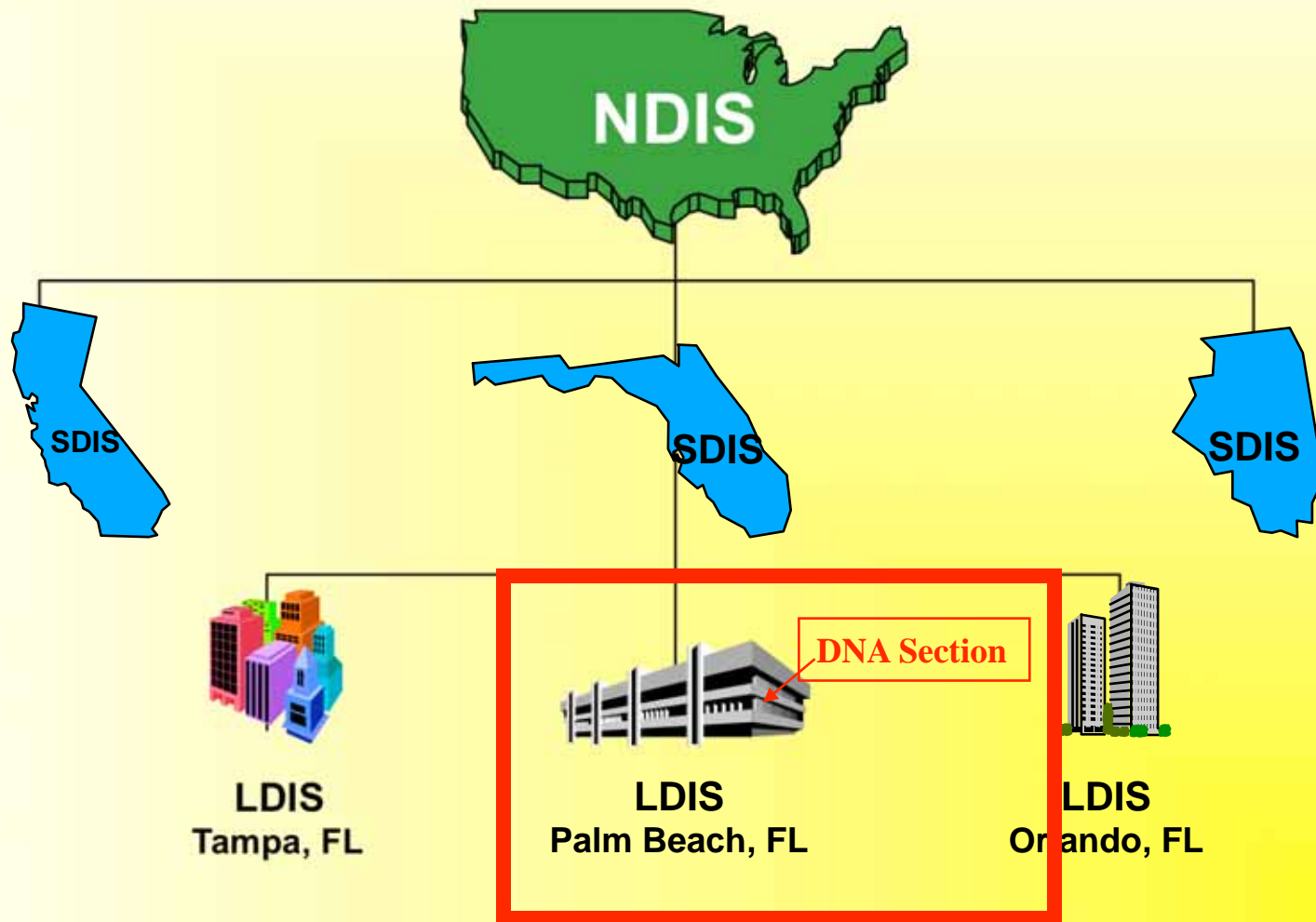
# At a Crime Scene, when considering submission of “touch evidence”

Ask yourself:

1. Is it in a commonly touched area: door knob, dresser drawer knob, door plate?
2. Is the item coarse and patterned or smooth?
3. Would it be better to go for fingerprints first?
4. Why is this item informative?
5. Should it be prioritized?
6. Can the laboratory help make this decision?
7. What types of standards should I get



# So What Can Go Into CODIS?





# So What can go into CODIS?

Unknown profile Homicide 5-18-08



Enter DNA profile  
Into PBSO  
CODIS



Statewide  
DNA  
Database



**CONTINUE  
INVESTIGATION**



***DNA PROFILE FROM  
GUN MATCHES DNA  
PROFILE FROM  
CONVICTED OFFENDER***

**DOC#01-132485  
Car Jacking Conviction  
10-21-01**



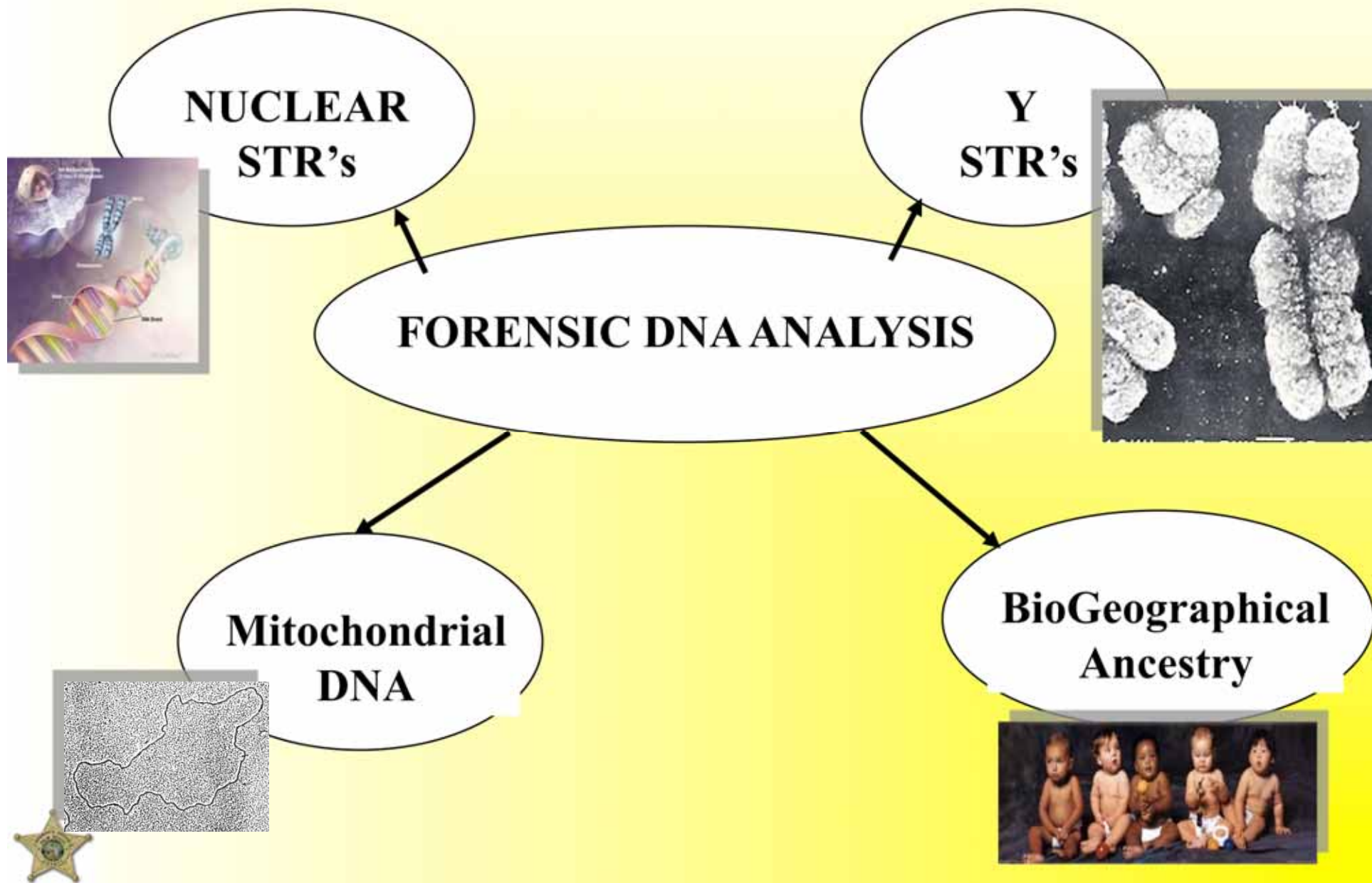


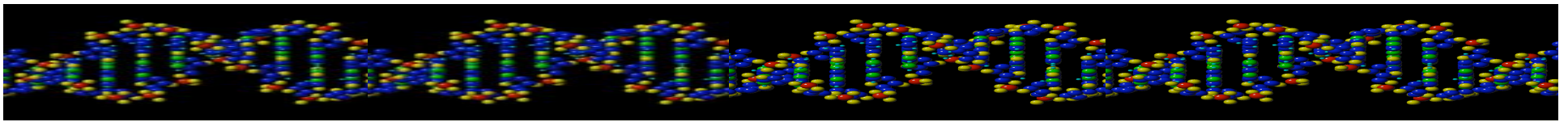
# Developments in Forensic DNA Technologies

What should you be thinking about  
at the crime scene?



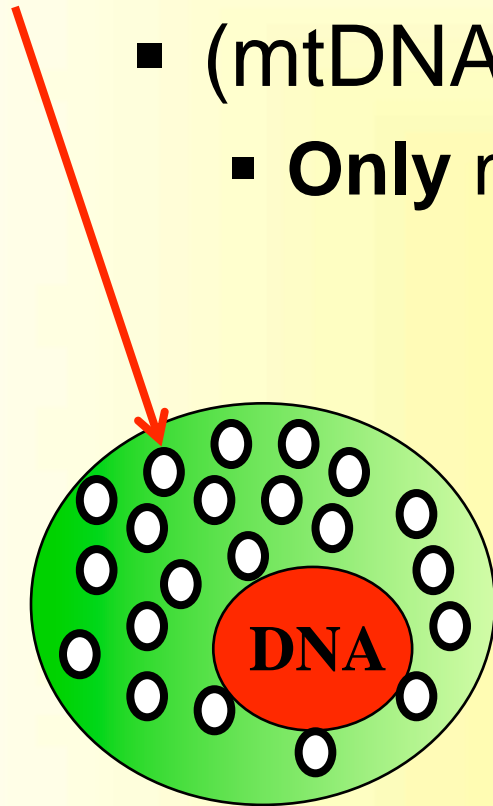
When the lab's nuclear DNA does not generate results OR...  
Need more information, there are other DNA technologies...





# Mitochondrial DNA (mtDNA)

- (mtDNA)
  - **Only** mtDNA from mother is inherited



**1 EGG  
(MOM)**

+

mtDNA located on the  
sperm's tail

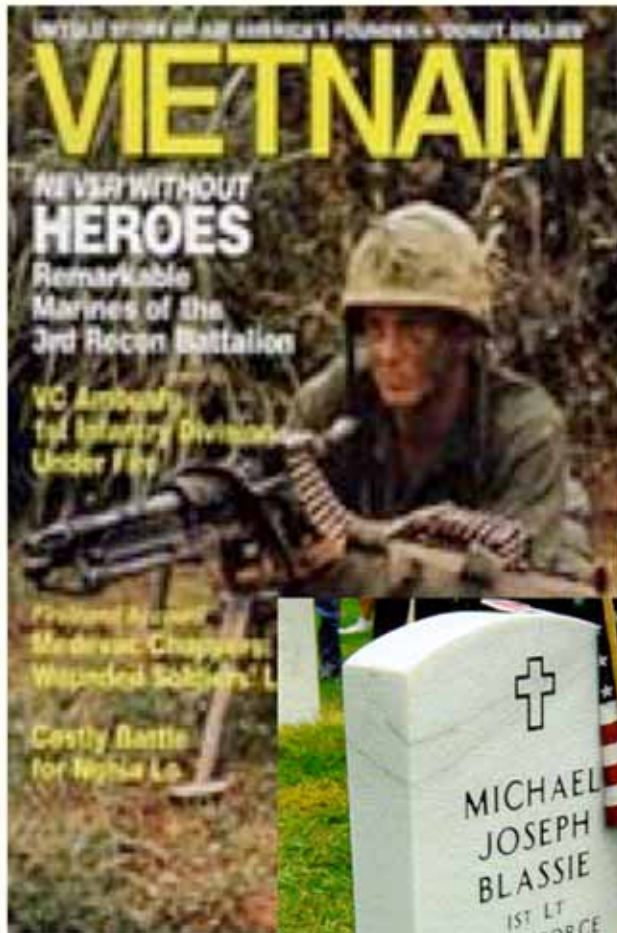


**1 Sperm  
(Dad)**







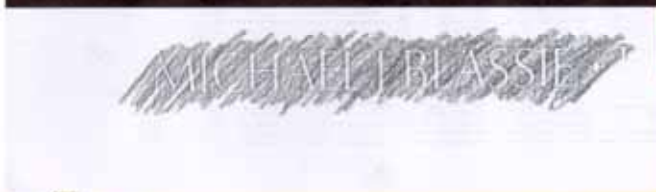


## Identification of Skeletal Remains from Previous Military Conflicts

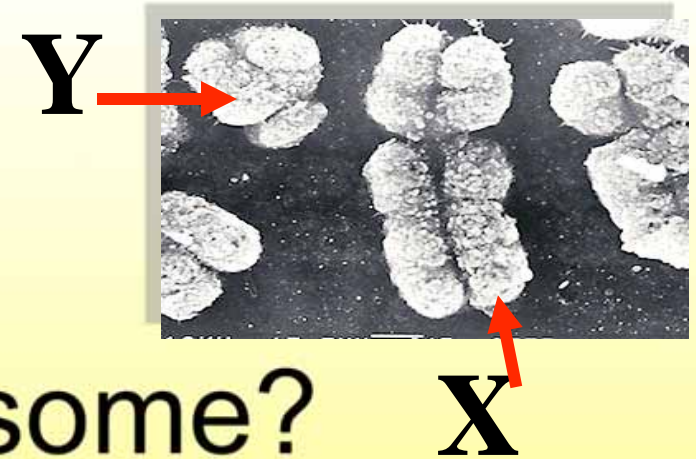
### Identification of Michael J. Blassie - Vietnam Tomb of the Unknown

- >2100 Unaccounted for from SEA
- >8000 Unaccounted for from Korea
- >75,000 Unaccounted for from WWII

Vietnam Veterans Memorial



## Y-STRs



## Why the Y Chromosome?

### ➤ Applications of YSTRs

forensic investigations (98% of violent crime by men)

genealogical purposes

evolutionary studies

### ➤ Y chromosome-Male DNA only

Fingernail scrapings

Sexual Assault -Low sperm count/vasectomies

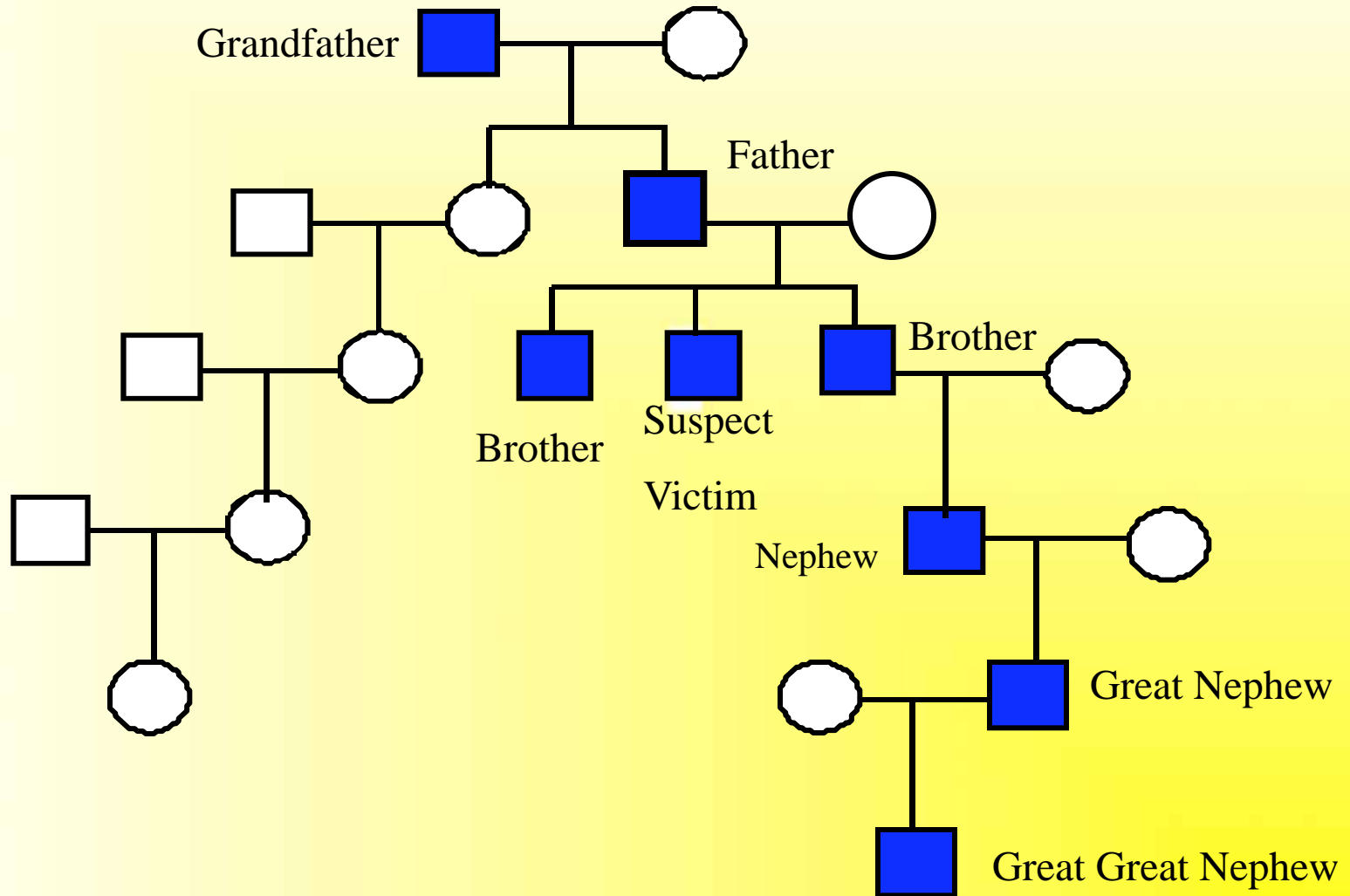
Gang Rape – Aid in excluding potential suspects

Body swabbing(s) – Male/Female mixtures





# Paternal Inheritance



➤ **Presumptive DNA Test**

➤ **Four Anthropological Groups**



# Louisiana Case

Gina Green



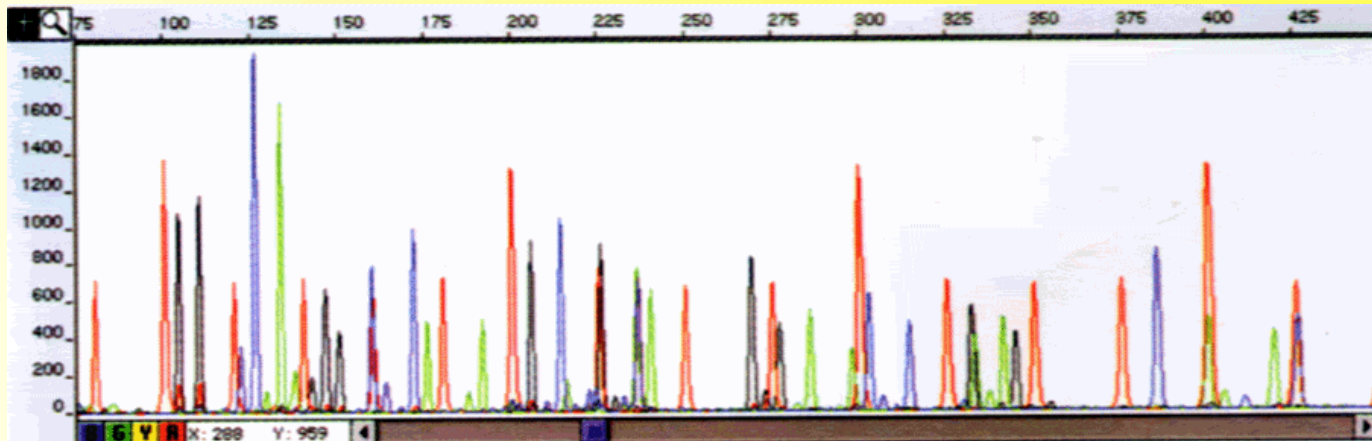
Baton Rouge

Charlotte Murray Pace



Baton Rouge

Pamela P. Kinamore



# Louisiana Case



# Louisiana Case



# Louisiana Case





# Louisiana Case



# What else is new???





# Assays for Body Fluid Identification

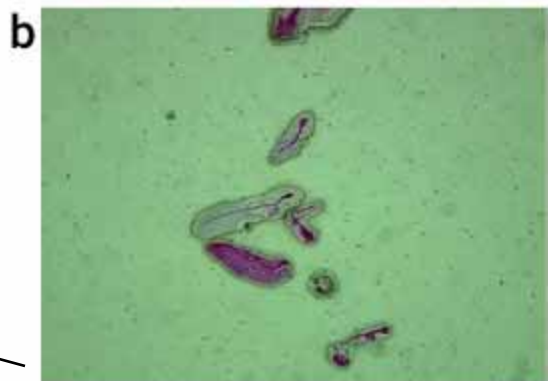
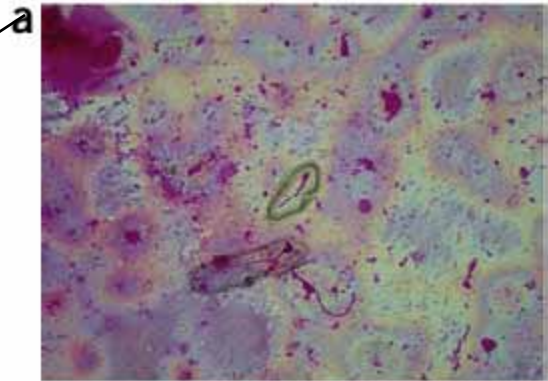
- Using special protein markers –mRNA & Protein assays
  - Menstrual blood
  - Saliva
  - Urine
  - Vaginal secretions
  - Seminal fluid
  - Feces



# Tools Available for Screening:

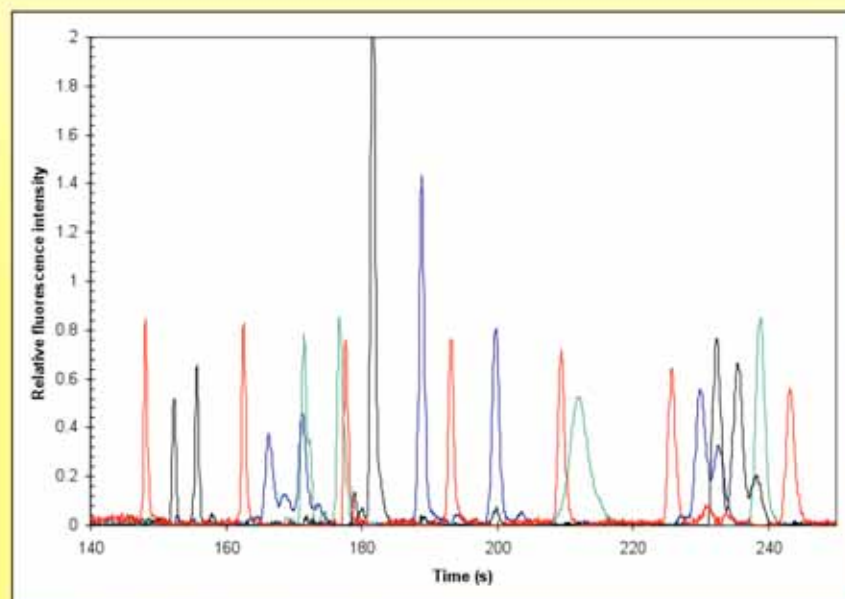
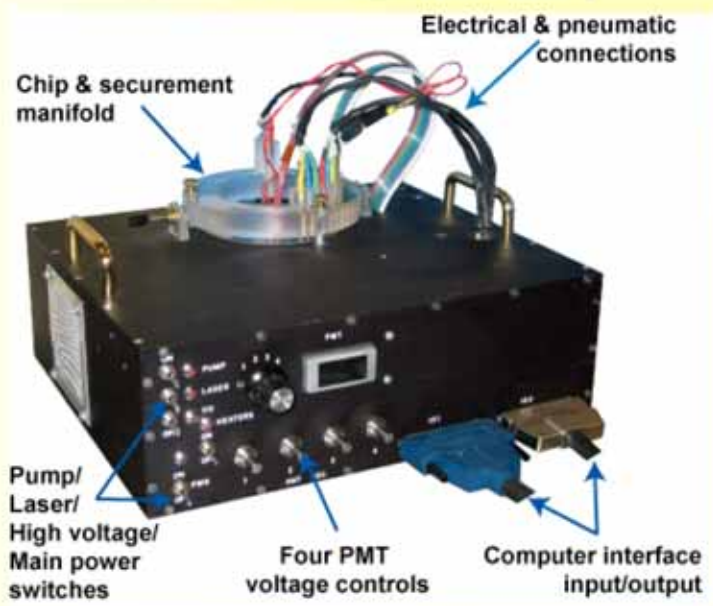
## 1) Sperm Identification & Isolation

- Sperm HY-LITER
- Laser Microdissection
- Can be automated with special scopes



# Portable Instrument for Forensic Analysis

## Portable Instrument



PBSO Mock Crime Scene  
Results

- Dimensions 10 x 12 x 4 inches
- Integrated laser and four-color detection
- Pneumatics & electronics for PCR & CE



# So why should the shirt be collected and submitted to the DNA lab?

**Detective:** The Perpetrator of the homicide was seen dropping the shirt in the field next to the building where the homicide occurred

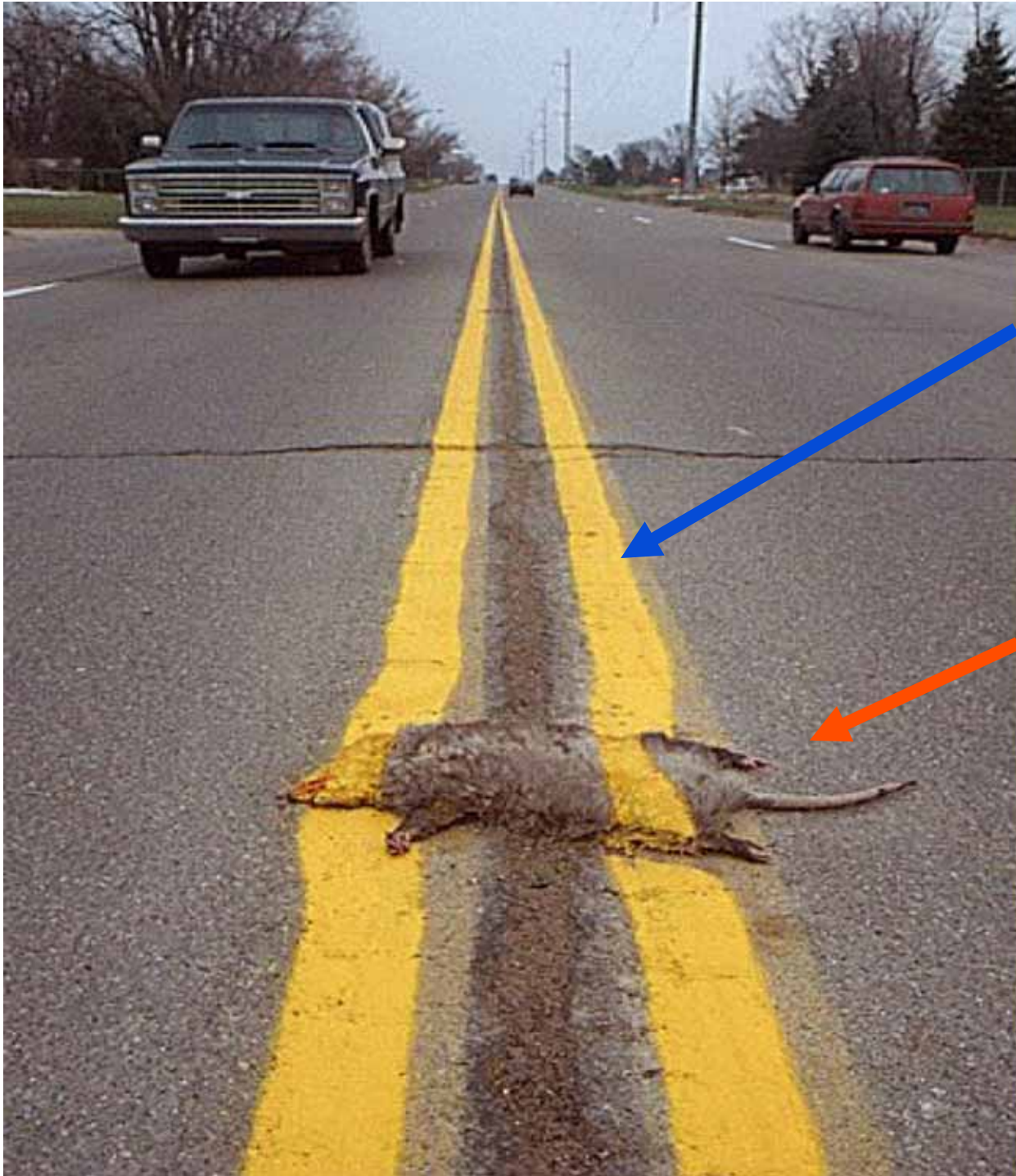
**CSI:** The shirt was found bloody and half in the water-filled gutter and needed to be packaged in a special ventilated system in order to begin drying the shirt while making sure the trace evidence was not lost.

**DNA Lab:** The shirt needed to be tested for skin cells to compare to the suspect and the blood needed to be compared to the victim.

## =Communication







**Court**

**Case**



**Thank you**

