Recovery of DNA off Fired Cartridge Casings

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Future Trends in Forensic DNA Technology Seminar
Philadelphia, PA
December 4-5, 2018

The Problem: Guns Used in Violent Crimes

San Diego

12% of aggravated assaults

18% of robberies

53% of homicides

Source: *San Diego Union-Tribune,* October 7, 2018

Firearm Sample Collection

- Guns generally processed by Crime Scene Unit
- First swabbing is of textured areas
- Then firearm is processed for prints
- Second swabbing is of non-textured areas

- DNA analyst has the option of combining the two swabs after quantification

Investigations require information

The lab receives dozens of requests per year for DNA analysis on casings recovered at shooting scenes.

- What do we do with these requests?
  - Setting testing priorities?
  - Just do IBIS?
  - Latent print vs DNA success rates?
  - Compromised evidence?
  - Juggling unit backlogs?

SDPD Initial attempt at testing casings

- **64** Total number of requests
- **114** Total cartridges/casings analyzed
- **5** Interpretable DNA profiles

All interpretable profiles came from unfired cartridges.

6.3% Success on cartridges (n = 79)

0% Success on casings (n = 35)

Note: Shot shells and cartridges swabbed with the magazines they were contained within not included in totals

Int J Legal Med (2011) 125:597–602
DOI 10.1007/s00414-010-0454-4

TECHNICAL NOTE

A sensitive method to extract DNA from biological traces present on ammunition for the purpose of genetic profiling

Patrick Dieltjes · René Mieremet · Sofia Zuniga · Thirsa Kraaijenbrink · Jeroen Pijpe · Peter de Knijff

Received: 10 August 2009 / Accepted: 31 March 2010 / Published online: 24 April 2010

- Reported **26.5%** of submitted casings (2003-2009) yielded DNA results.
- Success was defined as the number of profiles with results for at least one locus.

Can we recover DNA from Casings?

Forensic Science International: Genetics 17 (2015) 70–74

Contents lists available at ScienceDirect

Forensic Science International: Genetics

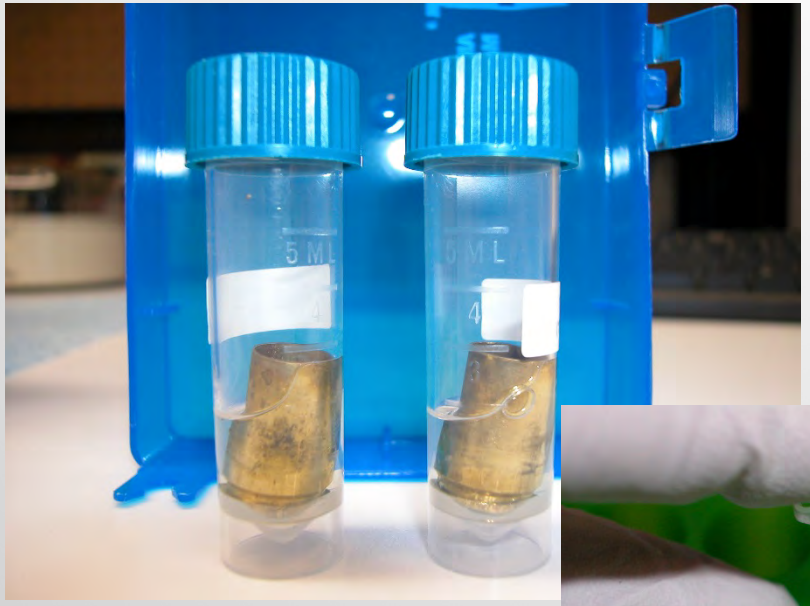
journal homepage: www.elsevier.com/locate/fsig

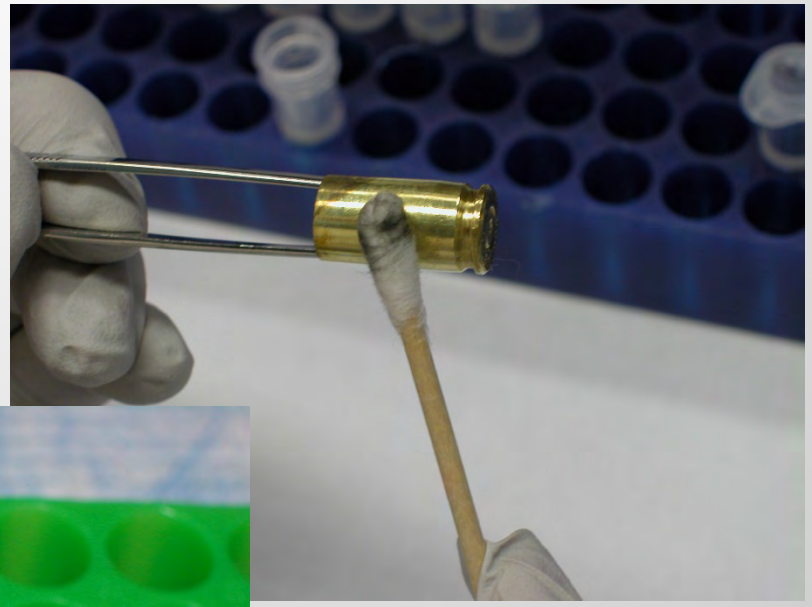
An optimized procedure for obtaining DNA from fired and unfired ammunition

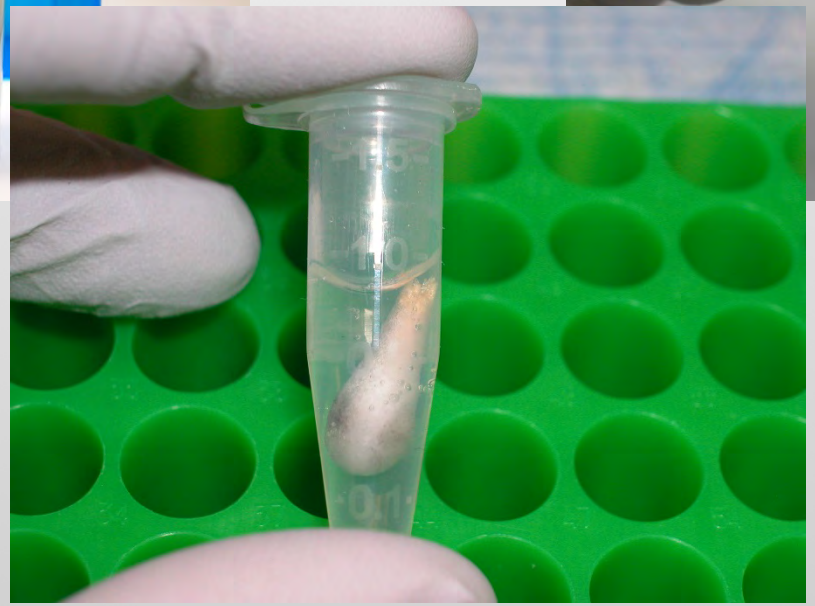
Shawn Montpetit *, Patrick O'Donnell

San Diego Police Department, 1401 Broadway, MS 725, San Diego,CA 92101, USA

The Process







Publication Highlights

- **34.7%** of soaked samples produced interpretable DNA results.
- **95.6%** of samples had the loader's DNA.
- **39.9%** of samples were mixtures (additional types observed in addition to known loader genotype).
- **31.0%** of samples with no prior handling, other than loading the magazine, produced mixtures
- 2 interpretable profiles had DNA from the 3 yr. old son of the loader *(who never touched the cartridges)*

https://www.flickr.com/photos/25888302@N06/4357949602/

Issues for DNA Analysis on Casings

✗ DNA destroyed by heat of gun powder ignition

✗ DNA testing not sensitive enough

✗ Copper ions are a PCR inhibitor

✓ Very little DNA and high proportion of mixtures

Issues for DNA Analysis on Casings

- The low level mixture of DNA issue has largely been overcome through the use of probabilistic genotyping.

- Probabilistic genotyping is a powerful tool in the interpretation of low level DNA data.

Does this translate to Casework Success?

- **264** samples
  - **99** discontinued after quantification *(<20 pg)*
- **165** amplified with GlobalFiler
  - No DNA types detected : **7**
  - Uninterpretable *or* Unsuitable for comparison: **77**
  - Interpretable: **81**

- Of the samples amplified with GlobalFiler, **~49%** interpretable
- Overall, that is **30% of casings** yielded an interpretable result

Casework Success

- **81** interpretable samples amplified with GlobalFiler
  - **10** single source, **71** mixtures

- **29** samples had reference(s) provided for comparison
  - **15** samples had associations between a suspect reference and the evidence
    - LRs ranged from 1.22 x $\mathbf{10^3}$ (4 person mixture) to 1.90 x $\mathbf{10^{29}}$ (2 person mixture 94:6)

Casework Success

- CODIS searchable profiles?
  - Yes – National: **20**, State: **14**, Local: **4**
- Hits?
  - **5** samples hit to another case
  - **12** samples hit to individuals
- Of the samples amplified with GlobalFiler, **~11%** hit in CODIS
- Of ALL samples processed, **~4.9%** hit in CODIS

Comparison of Casing success to other touch DNA items

Casings → 165 samples 87.6% mixtures 30% success

Random Assortment of Touch DNA Evidence				
Evidence	**Number of samples**	**% Mixtures**	**# Interpretable**	**% Success**
Gear Shifter	13	76.9%	4	30.7%
Steering Wheel	29	73.3%	7	24.1%
Car - Other	26	88.8%	5	19.2%
Rocks	55	88.8%	14	25.5%
Tool - Crowbar	9	88.8%	5	55.5%
Tool - Screwdriver	21	76.2%	13	47.6%
Tool - Wrench	4	100%	1	25.0%
Tool - Other	36	55.5%	10	27.7%

AM/PM Homicide

April 16, 2015

San Diego Police Department

Attempt to Locate / ID

Seeking the Public's Assistance

On Thursday April 16th, 2015, at approximately 3:43 a.m. an unidentified black male entered the AM/PM gas station at 6130 Balboa Avenue. The unidentified male pointed a handgun at the store clerk and one customer inside the business. He demanded the money from the register. During the robbery the customer inside the business was shot and later died at a local hospital.

The San Diego Police Department is seeking the public's assistance in identifying the suspect in the attached photographs.

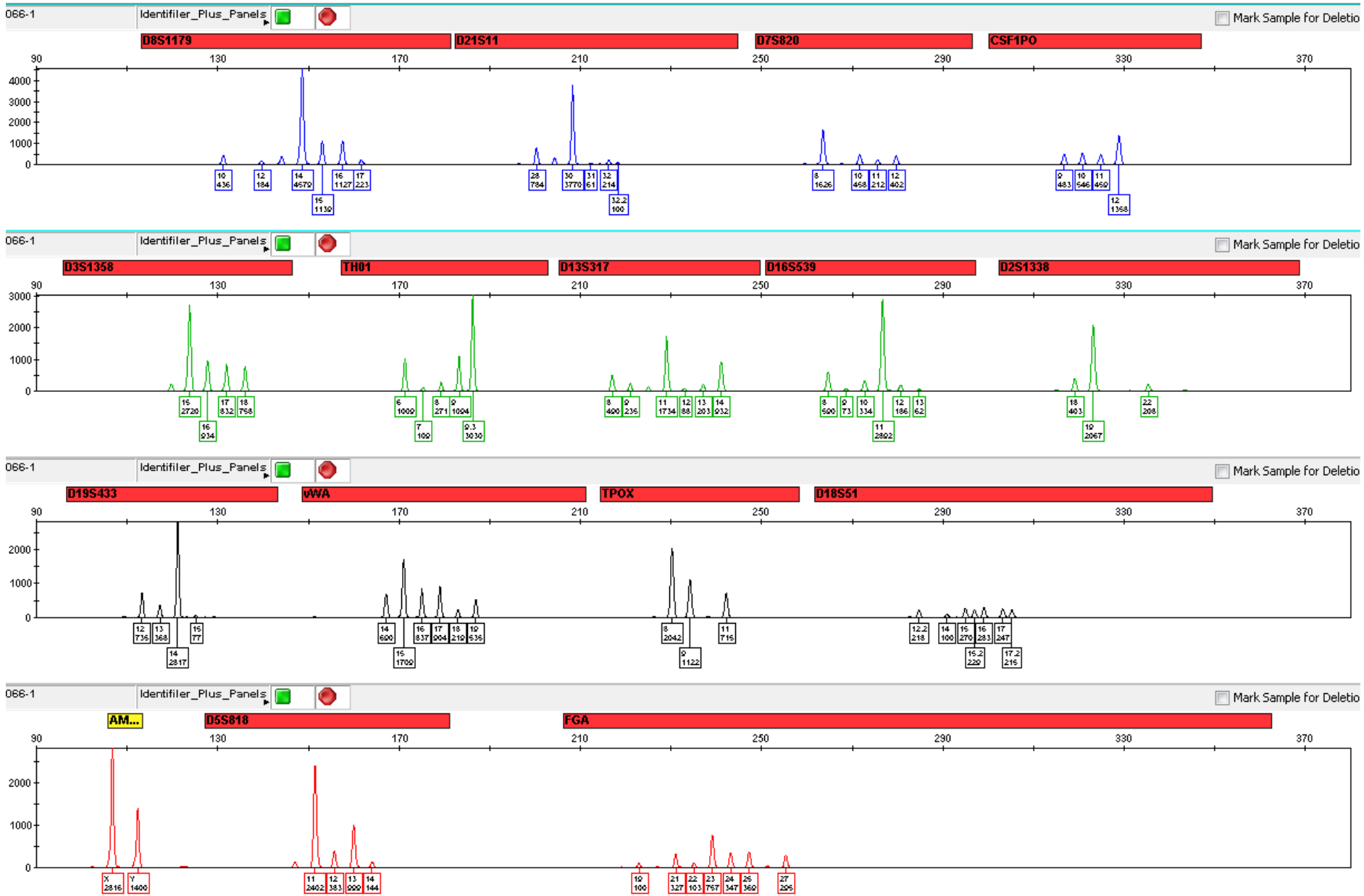
Anyone with information on the identity of the suspect is asked to contact the San Diego Police Department's Homicide Unit at 619-531-2293 or the San Diego Crime Stoppers Hotline at 619-531-1500 or 888-580-8477.

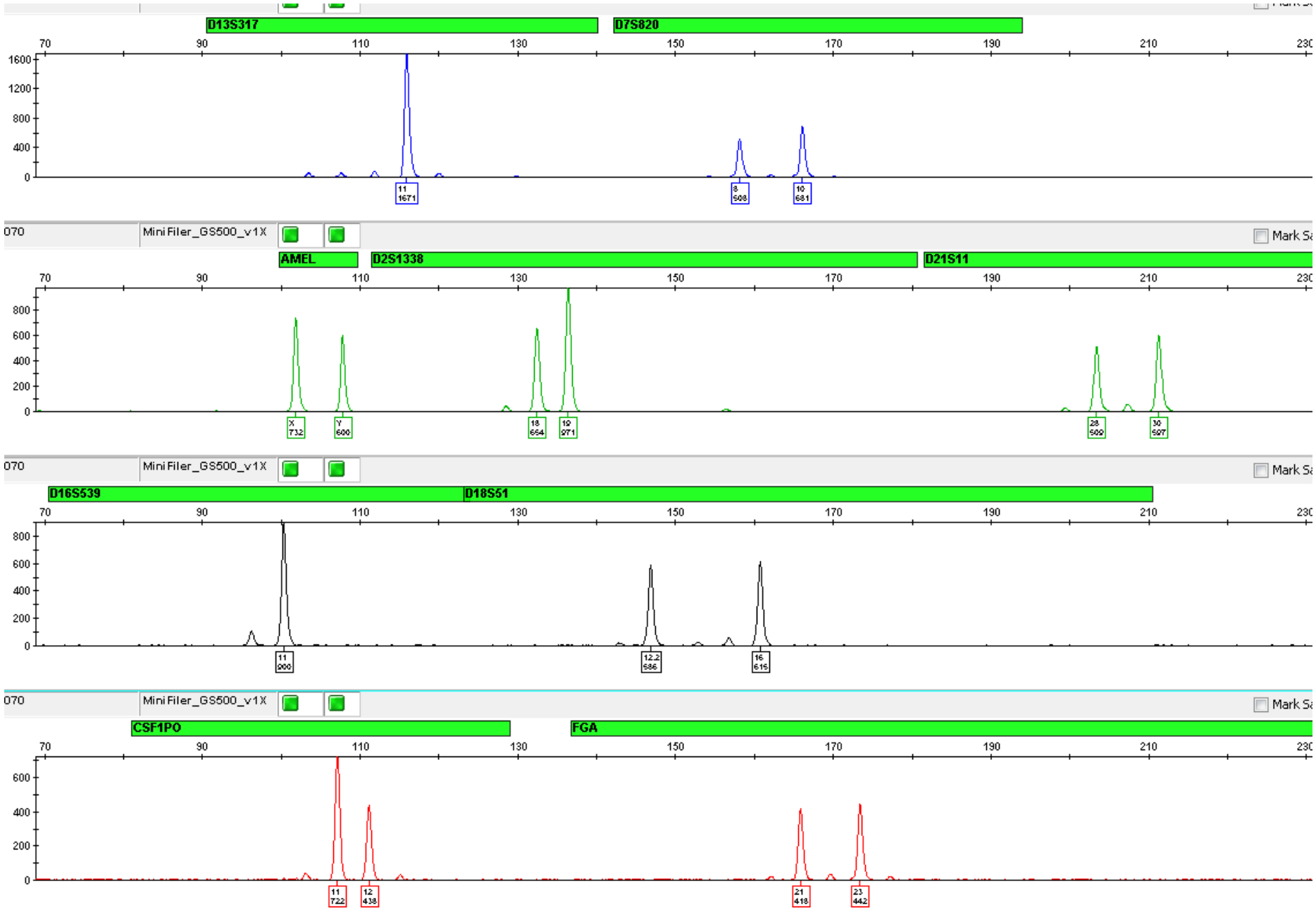
San Diego Police Department - Homicide Unit
1401 Broadway
San Diego, CA. 92101

Evidence

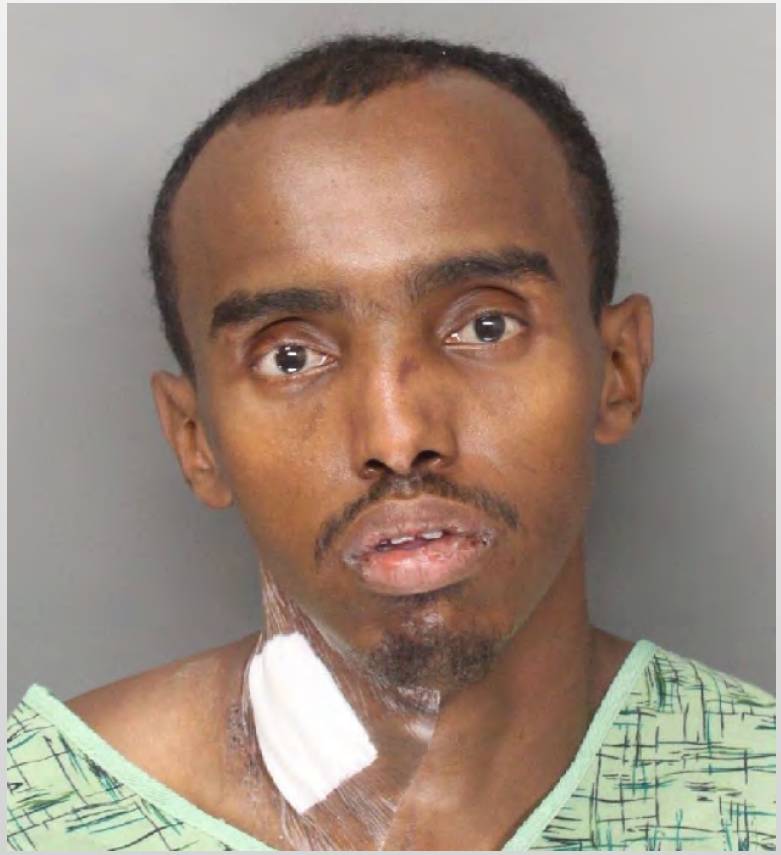

Cat. No. 09-016
Fisher Scientific


Cat. No. 09-016
Fisher Scientific
10478070


066-1
Identifiler_Plus_Panels
Mark Sample for Deletio
D8S1179
D21S11
D7S820
CSF1PO
D3S1358
TH01
D13S317
D16S539
D2S1338
D19S433
vWA
TPOX
D18S51
AM...
D5S818
FGA


D13S317
D7S820
AMEL
D2S1338
D21S11
D16S539
D18S51
CSF1PO
FGA
MiniFiler_GS500_v1X

Suspect Arrested
45 hours after homicide



April 12, 2014 homicide

- Gang-related homicide (shooting). 4 people shot. 1 killed. 3 survived.
- Investigators had no named suspects. Only a suspected gang set.
- 19 casings collected at the scene.
- Location of the casings and victim statements suggested 2 gunman.

April 12, 2014 homicide

Four casings yielded DNA. Two distinct DNA profiles obtained.

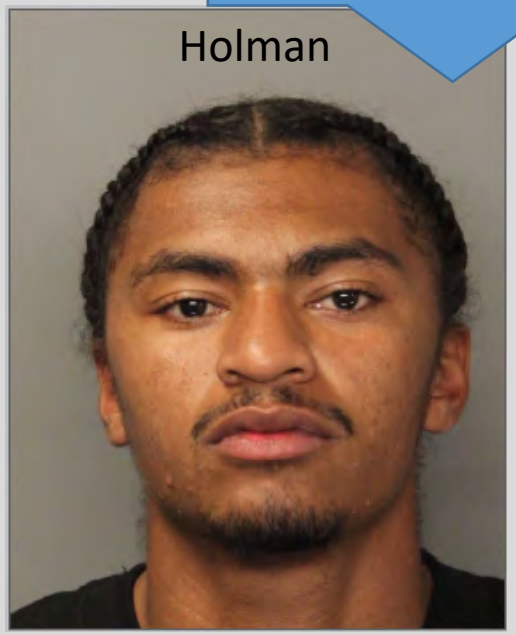
- 1 local CODIS hit to Emmanuel Peavy.
- 1 state CODIS hit to Lamont Holman.

April 12,

Emmanuel olm d
and placed was
recording

"I had no idea they could do that. That's probably not good for us."

"Did you know they could get DNA off the casings we left at the scene?"



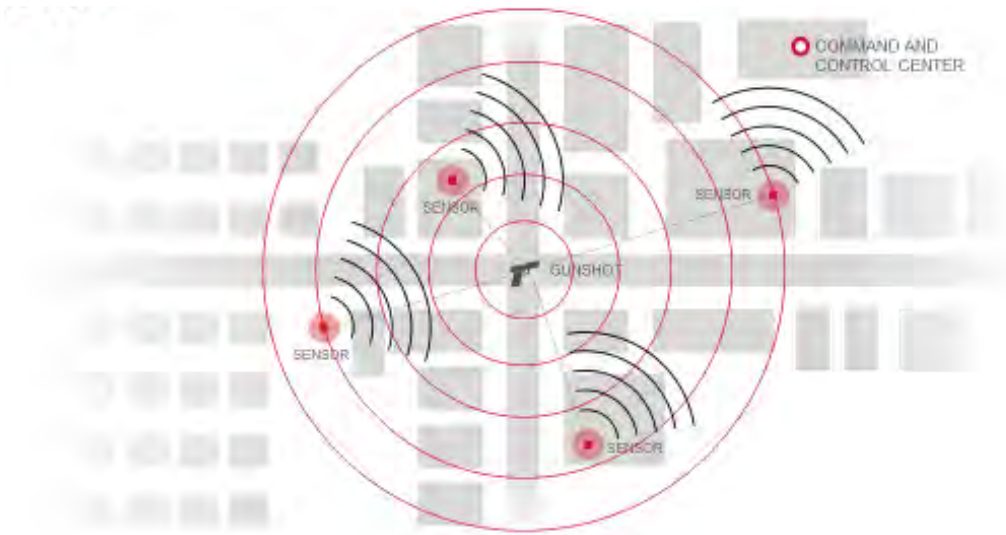
April 12, 2014 homicide

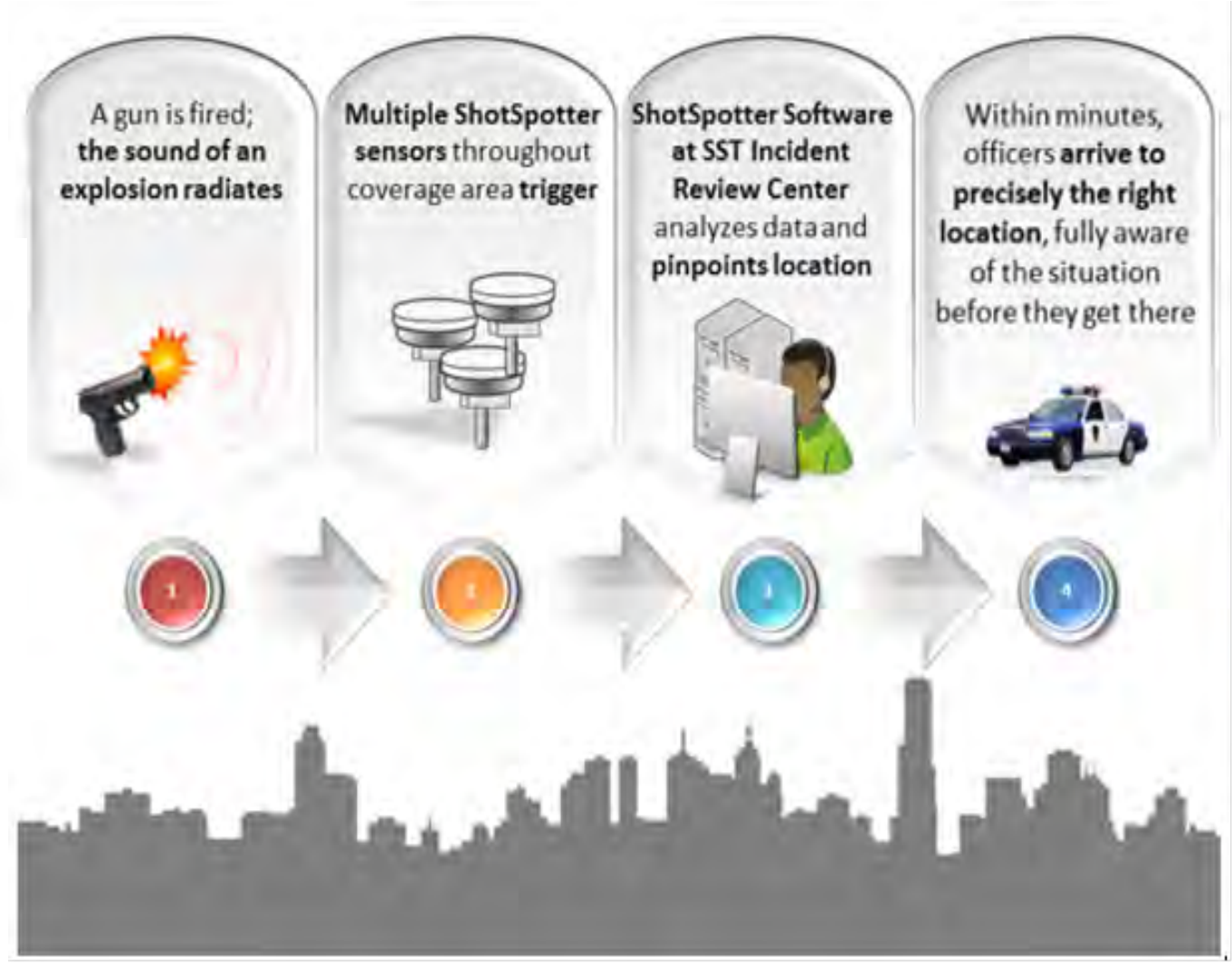
- Emmanuel Peavy and Lamont Holman were eventually charged for the April 12th homicide.
- Lamont Holman pleaded guilty and received a 38 year sentence.
- Emmanuel Peavy was convicted and sentenced to 89 years in prison.

December 24, 2013 Double Homicide

- A young couple was shot killed while sitting in their car in a mall parking lot.
- A cartridge casing was located on the back seat of the car.
- A robust, single source, DNA profile was obtained from the casing.
- This profile matched the male victim's elderly father who was excluded through traditional investigative means.
- Eventually a loner named Carlo Mercado confessed to the murders and is serving a life sentence.

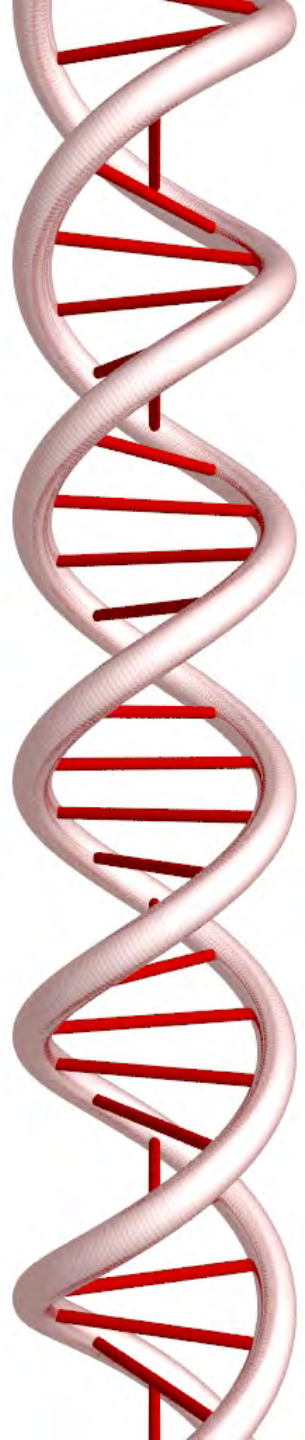
John Gibbins / San Diego Union-Tribune


COMMAND AND
CONTROL CENTER
SENSOR
SENSOR
GUNSHOT
SENSOR
SENSOR


A gun is fired; **the sound of an explosion radiates**
Multiple ShotSpotter sensors throughout coverage area **trigger**
ShotSpotter Software at SST Incident Review Center analyzes data and **pinpoints location**
Within minutes, officers **arrive to precisely the right location**, fully aware of the situation before they get there
1
2
3
4

The Great Debate:
"We aren't going to do DNA on them right?"

- ATF strongly discouraged us from attempting DNA
  - We've tried, and it can't be done
  - Just going to delay the firearms work/IBIS entry
- Has a crime even been committed?
  - Are we going to run into CODIS eligibility issues?
- How many casings are we going to get?
  - Are we going to end up with a huge case backlog?



ShotSpotter Statistics (11/2016 – 2/2018)

- **277** ShotSpotter activations (**213** did not have a party reporting gunfire)
- **18** of these were determined to be construction, drums, or firework noise
- **78** total activations on NYE for celebratory fire
- **100** casings collected in **29** activations
  - **13** casings resulted in a CODIS eligible profile
  - **1** arrest was made as a result of DNA from casings

In Summary….

- Casings are often the only evidence at shooting scenes.
- Success rates can be higher than expected depending on process used.
- Cases can be solved directly or indirectly through identity information developed from DNA testing, *<u>however</u>, DNA on a casing should be treated as an investigative lead*.

Making a Difference?: Guns Used in Violent Crimes

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Source: *San Diego Union-Tribune,* October 7, 2018

Acknowledgments

- San Diego Police Department

  Shawn Montpetit, DNA Technical Manager

  Roxanne Kotzebue, Criminalist

  Patrick O'Donnell, Supervising Criminalist (retired)

  SDPD Forensic Biology Unit

- Thermo Fisher Scientific