DOJ-BUREAU OF JUSTICE ASSISTANCE

DNA UPDATES & CONSIDERATIONS FOR CHALLENGING EVIDENCE

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BJA
Bureau of Justice Assistance
U.S. Department of Justice

My Background & Role

- Over 18 years of experience as a forensic specialist working on complex violent crime cases and missing/unidentified persons' investigations:
  - Prior positions:
    - Forensic Scientist - Queensland State Crime Lab, Australia
    - Director of Forensic Casework at Bode Technology
    - Forensics and Unknown Victim Identification Project Manager at the National Center for Missing and Exploited Children (NCMEC)

- **Forensics Unit Supervisor at DOJ- BJA (Law Enforcement Division)**
  - DOJ liaison to FBI Violent Criminal Apprehension Program (ViCAP)
  - Forensic DNA & Serology Subject Matter Expert (SME) for FBI Behavioral Analysis Unit (BAU) 3 and 4
  - Member of the DOJ Forensic Science Working Group

Three Factors that Impact a Laboratory's Success in Obtaining a DNA Profile:

Screening and Sampling Methods

Extraction Method

Amplification Method

Is an item really negative for semen/male DNA based on serology only?

- Frequently see reports from the 80s/90s stating no semen detected and no further work is done on the evidence in question.

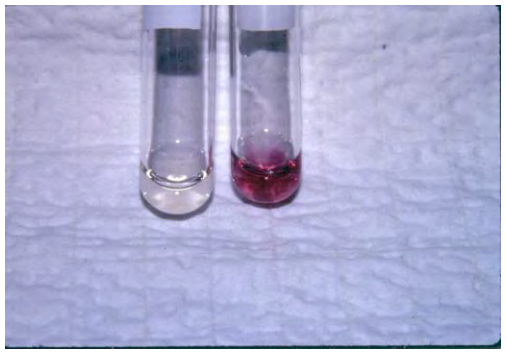
- Most investigators take the above statement as infallible and don't push for additional testing, and most labs don't have the time or resources to re-visit with a straight to DNA approach.

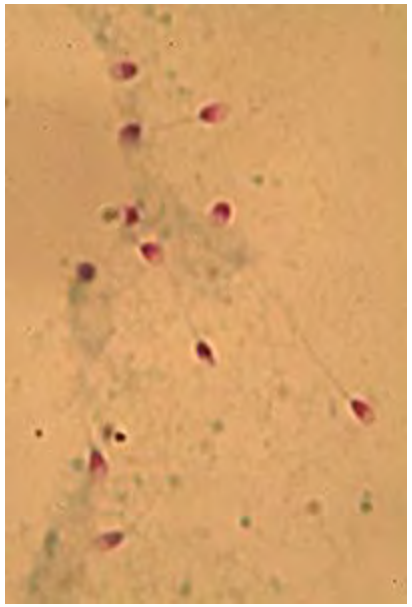
- BUT Under SAKI and FBI BAU consults we are seeing numerous examples of such samples actually being positive for semen and/or male DNA and producing probative profiles, often suitable for CODIS upload.

Tammy Welch Homicide

- 1984 cold case rape/homicide of 11-year-old girl
- State laboratory and FBI laboratory stated no semen present
- Child had suffered severe vaginal trauma with profuse bleeding
- Touch DNA on clothing failed to yield probative results
- Is there really no semen/male DNA present?

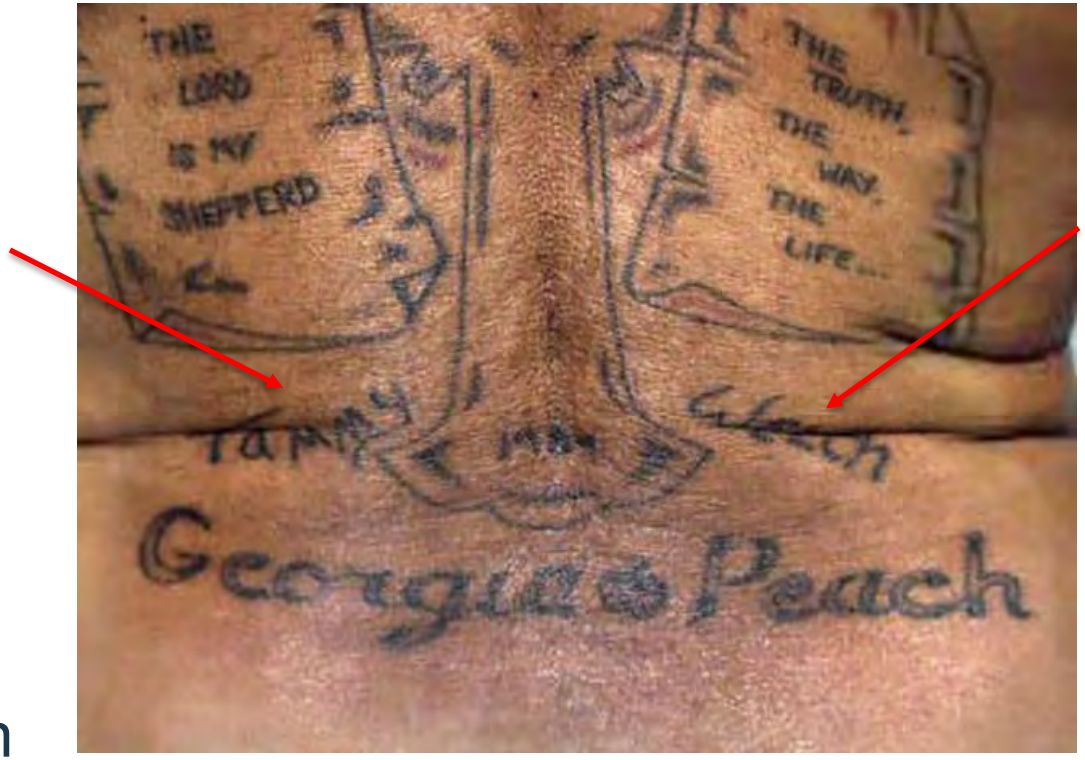
AP, Sperm, and p30 test





Tammy Welch Homicide

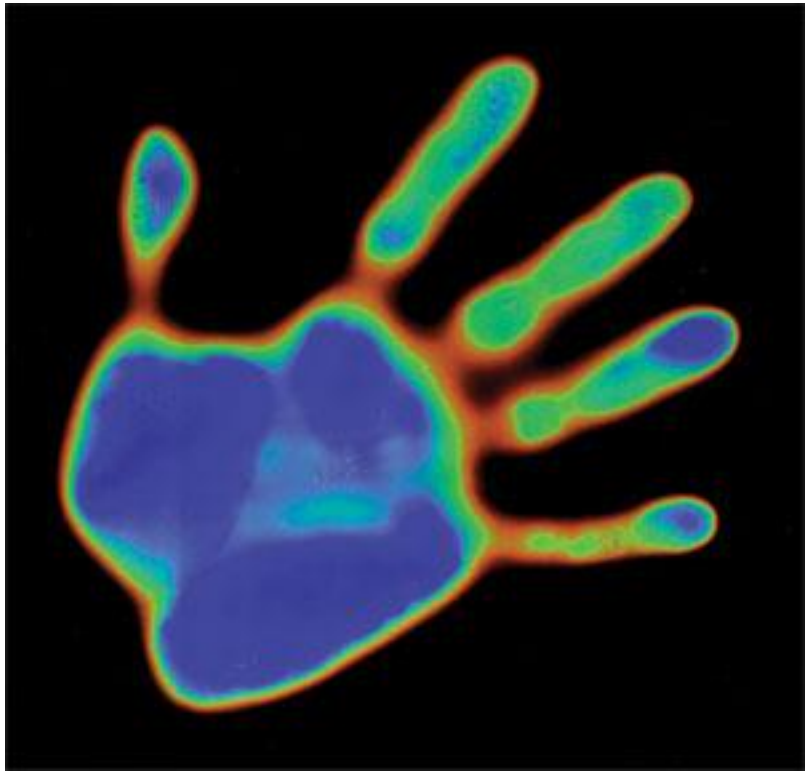
Upstairs neighbor- James Jackson linked via Y-STR profile from semen on vaginal swabs



Don’t Forget about Y-STR Genealogy Surname Searches

- Genealogists can search the Y-STR profile from an unidentified suspect/victim in existing genetic genealogy databases.
- The search cannot only identify potential last names, but will also help narrow down ancestry.
- If they find no match to a last name within the databases, they keep the profile on file and monitor it for future matches.
- Good option when you don’t have enough DNA for SNP/WGS testing required for traditional genealogy searches.

Sampling for Touch/Wearer DNA



How do you think first responders were dressed at cold case crime scenes?

What are the implications in terms of DNA?

Before you Start Sampling:

- What is the condition of the evidence? Exposed to water? Bloody? Decomp fluid? Degraded?

- What are you looking for on the item?
  - Wearer DNA (more embedded in the fabric)
  - Touch DNA (on the surface of the fabric)

Scraping Technique

- Use of a scalpel blade to sample large area of an item instead of taking multiple cuttings or swabbing.

- Applications:
  - Crotch of underwear
  - Ski mask
  - Gloves
  - Baseball caps
  - Waistband of pants
  - Collar of shirt

Not recommended for use at the crime scene

Tape-Lifts

- Use of tape to obtain surface cells from items that are delicate or difficult to scrape.

- Applications:
  - Waistband of underwear (especially lace thong-style underpants)
  - Bra
  - Nylons/Pantyhose
  - Ligatures

Not recommended for use at the crime scene

Post-it Note (Low-Tack Tape)

- Use of low-tack tape to remove surface cells from items that are difficult to swab, scrape, or tape-lift.

- Applications
  - Toilet Paper
  - Tissue (Kleenex)
  - Hair Net

Not recommended for use at the crime scene

Wet/Dry Swabbing

- Most common method used in state/local laboratories.
- Use of a wet swab, followed by a dry swab to remove surface cells from smooth, non-porous items that are difficult to scrape, or tape lift.

Recommended for use at the crime scene

- Applications
  - Guns
  - Door handles
  - “Handle” section of sex toys
  - Knife Handles
  - Outside of bottles
  - Steering wheels
  - Latent prints
  - Ransom notes

Swabbing clothing for Touch DNA is not ideal

To M-Vac or not M-Vac

- Expensive
- Wets item = cannot retest
- Increased chance of detecting contamination
  - Have to address unknown DNA with your DA/in court
- Collects more wearer DNA
- Not good for bloody items
- Any better than scraping/tape lifts?

Not recommended for use at the crime scene

The Collection of Additional Touch DNA Body Swabs in Suspicious Death and Suspected Homicide Cases

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What are “Additional Body Swabs”?

- A swabbing taken from an area on a victim’s body in which a perpetrator ***might*** have touched or contacted with their own body

What are “Additional Body Swabs”?

- Obvious areas
  - Bruises
  - Neck (strangulation cases)

- Less obvious areas
  - Ankles
  - Thighs
  - Breasts
  - *Any exposed areas of skin

Case Study #1

- A young child was abducted on the way home from school.
- Her body was recovered several days later in the local landfill.
- She had been sexually assaulted and strangled or suffocated.
- Suspect DNA was successfully obtained from different areas of the child's body including genital areas and her feet.
- When faced with the DNA results, the suspect provided a full confession to the crime and pleaded guilty.

Case Study #2

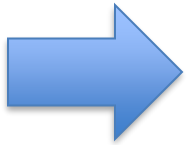
- An adult female was strangled and beaten to death.
- Her body was found nude with the exception of a single piece of clothing.
- Early investigation resulted in the victim's partner being arrested based on circumstantial evidence.
- Body swabs of the victim's ankles, wrist and arms were taken at autopsy and yielded a consistent Y-STR profile that did not match the partner, resulting in his release.

Case Study #2, cont.

- A consistent Y-STR profile was also developed from an article of clothing.
- Further analysis of the clothing yielded a STR profile that was uploaded into CODIS. The profile hit to an individual who was ultimately convicted of her murder.

Is every jurisdiction collecting additional body swabs?

Lack of standardization in evidence collection protocols



MISSED OPPORTUNITIES to collect valuable evidence that can aid in resolving cases and ultimately serving justice

Missed Opportunity #1

- An adult female was found stabbed with mutilation wounds in a public setting.
- There were signs that the perpetrator had most likely had significant contact with certain regions of the victim's body including her breasts and thighs. Both areas were void of blood at the scene, however, swabbings of those areas were not taken at the scene.
- During transport, blood from the victim's wounds pooled and spread over her entire body. The victim was then washed in preparation for autopsy, completely eliminating the chances of collecting any touch DNA from the aforementioned areas.

Missed Opportunity #2

- A teenage victim was suspected of being sexually assaulted before being strangled and set on fire in an outdoor setting.
- It was apparent that the victim had been dragged by her feet/ankle areas. The majority of the victim's body surface was significantly burned, however, her feet/ankles remained untouched by the fire.
- No swabbings of these areas were collected at the scene and the victim's body was washed for autopsy without the collection of swabs at the morgue.

Current practices

- There is minimal literature available on the collection of additional body swabs as a means to develop touch DNA profiles.
- We reached out to SAKI grantees and MEC subject matter experts within SAKI jurisdictions.
- The collection of additional body swabs in suspicious death or suspected homicide cases is only standard practice for some MECs.
  - Example- Dane County (WI) MEO

Recommendations

1) The collection of additional body swabs should be considered in *any homicide or suspicious death case* in which physical contact is likely or suspected to have taken place.

Recommendations, cont.

2) The collection of body swabs should be considered *both at the scene and during autopsy.*

- It is ideal to collect samples within controlled morgue environment during autopsy.
- Consider collecting at the scene when there are concerns about contamination or loss.
  - Weather
  - Extent of injuries that a forensic pathologist needs to examine
  - Transportation logistics

Recommendations, cont.

3) Additional swabs should be collected from areas of the body *based on scene findings and circumstances of the crime*.

Recommendations, cont.

4) Additional body swabs should be sent to the laboratory for testing *based on the needs of the investigation*.

Recommendations, cont.

5) The implementation of standard operating procedures and policies can address logistical considerations associated with the collection of additional body swabs.

JURISDICTIONS WHO COLLECT ADDITIONAL BODY SWABS ESTIMATE THAT IT ONLY TAKES 15-30 MINS, INCLUDING DOCUMENTATION

DON'T MISS THE OPPORTUNITY TO OBTAIN POTENTIALLY VAULABLE EVIDENCE

COLLECT THE EXTRA SWABS!

What about all those complex mixtures? Probabilistic Genotyping - STRmix

- The use of statistical methods and mathematical algorithms in DNA profile interpretation.
- STRmix™ is expert forensic software, developed by ESR and Forensic Science South Australia (FSSA), that can resolve previously unresolvable mixed DNA profiles.
- STRmix™ combines biological modelling and mathematical processes to interpret a wide range of complex DNA profiles. Using well-established statistical methods, the software builds millions of conceptual DNA profiles. It grades them against the evidential sample, finding the combinations that best explain the profile.

What about all those complex mixtures? Probabilistic Genotyping - STRmix

- It may be used instead of manual methods in difficult situations, such as when a DNA sample is very small or includes a mixture of multiple individuals' DNA.

- STRmix is the most popular mixture software used in the U.S., currently implemented in 63 laboratory systems. By using more information from the crime scene profile, laboratories can examine samples that were previously uninterpretable using a binary approach. More profiles can now be used to search CODIS in no-suspect cases.

- The use of mixture software has now been admitted into court on numerous cases.

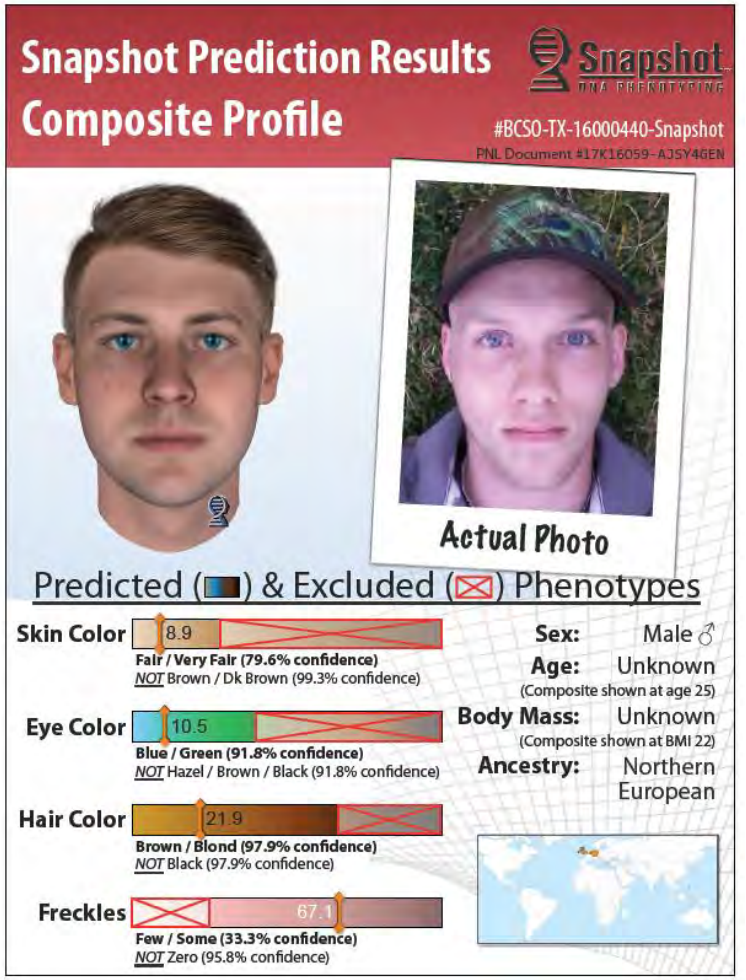
THE APPLICATION OF SNP-BASED TECHNOLOGIES TO SOLVE VIOLENT CRIMES

SNPs - Single nucleotide polymorphisms

- The most common type of genetic variation among people.
- Each SNP represents a difference in a single DNA building block, called a nucleotide.
- Basis of forensic genealogy searches and phenotypic/ancestral traits
- Not eligible for CODIS upload

Phenotypic and Ancestral DNA Profiling

- Can determine ancestral and phenotypic traits of the suspect linked to your unknown crime scene evidence profile.
- Predicts:
  - Eye color
  - Hair color
  - Skin color
  - Freckles
- Provides a computer-generated composite which is not accurate, but is helpful for media purposes and serves as a visual representation of the DNA results.
- Costs ~$3,000
- But rarely now needed thanks to FGG……



Forensic Genetic Genealogy

"Law enforcement's use of DNA analysis combined with traditional genealogy research to generate ***investigative leads*** for unsolved violent crimes"

https://www.justice.gov/olp/page/file/1204386/download

UNITED STATES DEPARTMENT OF JUSTICE
INTERIM POLICY
FORENSIC GENETIC GENEALOGICAL DNA ANALYSIS AND SEARCHING

I. Purpose and Scope[1]

The purpose of this interim policy is to promote the reasoned exercise of investigative, scientific, and prosecutorial discretion in cases that involve forensic genetic genealogical DNA analysis and searching ('FGGS').[2] It provides guidance to Department agencies when formulating a thoughtful and collaborative approach to important interdisciplinary decisions in cases that utilize this investigative technique. Collaboration between investigators, laboratory personnel, and prosecutors is important because the decision to pursue FGGS may affect privacy interests, the consumption of forensic samples, and law enforcement's ability to solve violent crime.

The Department must use FGGS in a manner consistent with the requirements and protections of the Constitution and other legal authorities. Moreover, the Department must handle information and data derived from FGGS in accordance with applicable laws, regulations, policies, and procedures. When using new technologies like FGGS, the Department is committed to developing practices that protect reasonable interests in privacy, while allowing law enforcement to make effective use of FGGS to help identify violent criminals, exonerate innocent suspects, and ensure the fair and impartial administration of justice to all Americans.

The Department will continue to assess its investigative tools and techniques to ensure that its policies and practices properly reflect its law enforcement mission and its commitment to respect individual privacy and civil liberties. This interim policy establishes general principles for the use of FGGS by Department components during criminal investigations and in other circumstances that involve Department resources, interests, and equities.

The scope of this interim policy is limited to the requirements set forth herein. It does not control investigative, scientific, or prosecutorial activities or decisions not specifically addressed. The Department's individual law enforcement components may issue additional guidance that is consistent with the provisions of this interim policy.

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[1] This interim policy provides Department components with internal guidance. It is not intended to, does not, and may not be relied upon to create any substantive or procedural rights or benefits enforceable at law or in equity by any party against the United States or its departments, agencies, entities, officers, employees, agents, or any other person in any matter, civil or criminal. This interim policy does not impose any legal limitations on otherwise lawful investigative or prosecutorial activities or techniques utilized by the Department of Justice, or limit the prerogatives, choices, or decisions available to, or made by, the Department in its discretion.

[2] As used in this interim policy, the term 'forensic genetic genealogical DNA analysis and searching,' or 'FGGS,' means the forensic genetic genealogical DNA analysis of a forensic or reference sample of biological material by a vendor laboratory to develop an FGG profile and the subsequent search of that profile in a publicly-available open-data personal genomics database or a direct-to-consumer genetic genealogy service.

Approved: 09.02.2019 Effective: 11.01.2019

Forensic Genealogy Searches

- Can be used to identify Unknown Sexual Assault or Homicide Suspects and Jane and John Doe Homicide Victims

- Must have sufficient quantity and quality of DNA available for the additional testing required:
  - 1 nanogram is ideal
  - Degradation index
  - Mixture ratio at least 50:50 if not single source
  - Presence of bacterial DNA vs. Human DNA

- Searches your unknown offender DNA profile in public genealogy databases to try and find close relatives and a potential last name
  - FTDNA and GEDMatch in the USA

Forensic Genealogy Searches, cont.

- Current success rate of providing a strong investigative lead using this methodology is ~70%
- Costs vary but typically around $3-5,000 per case
- Always recommend utilizing the FBI IGG Team for the tree building/investigative portion

DOJ/BJA-FBI IGG Partnership

- BJA works closely with the FBI Investigative Genetic Genealogy (IGG) team to leverage FREE federal resources to help resolve cases
  - Annual virtual training for grantees conducted every Spring- led by the FBI IGG team
  - In-depth 40h IGG training program in development for LEAs across the country
- Archived version can be accessed for free: SAKI Virtual Academy (sakitta.org)
- Instructors: Key members of the FBI IGG team
- Uniform training to ensure FGG is being utilized properly and that the technique is safe guarded to help solve more cases

Considerations before submitting for FGG

- It is highly recommended that DNA be extracted from ***physical crime scene evidence*** by an ***accredited laboratory*** to preserve the integrity of the evidence in the event additional testing is needed (for example, during the trial phase) rather than sending the actual physical evidence to a vendor FGG lab.

- This DNA extraction can be submitted to the FGG vendor for SNP/WGS analysis. (Please note, this suggestion does not always apply to unidentified human remains as enhanced extraction methods are often necessary to obtain enough DNA from bone samples, and these methods may not be offered by accredited laboratories.)

- If submitting ***physical crime scene evidence*** (as opposed to DNA extracts) to vendors for FGG analysis, it is essential that law enforcement consult with their crime lab prior to submission to discuss potential concerns to ensure sample is available in the event additional testing is needed, and/or the case proceeds to trial once a suspect is identified.

- And remember, the FGG CODIS requirement means that the specific sample being submitted for FGG must have a profile in CODIS. E.g. a singular blood stain, or vaginal swabs with remaining extract/sample. If a profile is in CODIS from a vaginal swab and none of that sample/extract remains, you cannot submit DNA from a rectal swab or victim underpants for FGG unless you know the same Unknown Suspect DNA is also on that sample.

WHAT TO DO WHEN YOU DON'T GET A CODIS HIT?

(BESIDES FORENSIC GENETIC GENEALOGY)

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Verify that any convicted offenders of interest are in CODIS and searching at the national level (NDIS)

- **If you suspect a specific convicted offender is responsible, contact the applicable State CODIS Administrator and ask them to verify that the offender is in NDIS** - you CANNOT assume that the offender is in NDIS:
  - You will need to provide the offender's Full Name, DOB, and State Identification Number (SID)
  - If the offender has DNA in CODIS but is not in NDIS you will need to request a direct comparison between your crime scene profile and the offender's profile. Your lab can arrange for this to happen at your request.
  - If the suspect was convicted of a Federal offense, you can submit an online inquiry to determine if they're in CODIS: https://forms.fbi.gov/fddu-fco-sample-status

What if your suspect died in custody without DNA being collected?

- Was an autopsy performed? The medical examiner/coroner may have retained a blood card or other tissue samples.
- Any evidence items from the trial remaining?
- What was the final disposition of the body? If buried, can you get permission for an exhumation?
- Are any first-degree blood relatives alive and willing to provide a DNA sample?

Ask your CODIS Administrator to Facilitate a Keyboard Search in States of Interest

- The suspect linked to the unknown profile from your crime scene evidence may be in CODIS but might only be at the local (LDIS) or state (SDIS) level in another state- this means you will not get a hit.
- Your crime scene profile can be shared with every CODIS administrator in the country and searched on a one-time basis against offenders/arrestees in their local/state database.
- Speak with your CODIS administrator directly if you think a keyboard search might be useful.
- **Start by targeting states of particular interest instead of all 50 states at once.**

Familial DNA Searches

- Familial searches are performed outside of CODIS and are currently conducted for specific cases by ~16 states including:
  - California, Texas, Virginia, Florida, Wisconsin, Arizona, Ohio, Michigan, Wyoming, New York
- Familial searches look for close 'matches' between crime scene DNA profiles and arrestee/convicted offender DNA at the state level
  - 1st or 2nd degree relatives – Father, son, brother, uncle
- Stringent criteria for familial searches has been set by all participating states
  - The DNA profile must contain core CODIS loci and there must have enough DNA extract remaining to obtain a Y-STR profile to assist with excluding/including potential family members

'The Grim Sleeper'
Lonnie Franklin Jr.

CAN YOU GET DNA FROM…..?

If evidence hasn't been tested in 3 years (or less if a brand-new technology has just launched), it might be worth revisiting.

Case File Evidence Review Checklist

- Incident Report
- Crime scene photos (note the PPE, or lack thereof, on first responders)
- Autopsy photos
- All evidence reports
  - What lab(s) were used?
  - FBI Cold Case Evidence Section is often a wealth of information
- Lab bench notes (if possible)

Case File Evidence Review Checklist

- What evidence still exists?
  - Don't forget about DNA extracts, cuttings etc
  - Evidence might be at the LEA, Lab, ME/Coroners office, Courthouse, Hospital
  - What is the current condition of the evidence?
    - Effects of packaging, storage (temps/humidity), time

- Remember- not all labs have the same methodologies available, and technology continues to rapidly evolve.
  - Utilizing your state/local lab in partnership with a private lab might be the best option.
  - LE and Lab staff need to work together to develop the best game plan!

NEW - the National Sexual Assault Kit Initiative (SAKI) Forensic DNA Services Technical Assistance program for Unidentified Persons

- There is a critical need in the field for funds to assist with the identification of unidentified human remains, with DNA being the most powerful forensic tool at law enforcement's disposal.

- The identification of Jane and John Doe homicide victims is not only crucial in providing investigative leads to identify suspects but also in repatriating the remains to their loved ones.

NEW - the National Sexual Assault Kit Initiative (SAKI) Forensic DNA Services Technical Assistance program for Unidentified Persons

- While the identification of Jane and John Doe victims is normally a service the National Institute of Justice (NIJ) contractually provides via the National Missing and Unidentified Persons Systems (NamUs), the waitlist for NamUs forensic DNA services is several years long.

- To address this critical gap, BJA recently awarded funds to The University of North Texas (UNT) to serve as a national provider to deliver forensic DNA services to SAKI site-based grantees working with Jane and John Doe sexually motivated homicide victims, specifically to provide CODIS eligible DNA testing and Forensic Genetic Genealogy (FGG) services.

Services for SAKI sites provided by UNT:

- ShortTandem Repeats (STR), Mitochondrial DNA (mtDNA), and Y-STRs for CODIS upload for sexually motivated homicide Jane and John Doe victim identification for SAKI site-based grantees, with particular focus on those sites with tribal, rural, and small entities.

- Retest for STRs, Y-STRs, or mtDNA as needed for older cases to enhance CODIS searching for sexually motivated Jane/John Doe homicide cases where initial testing only resulted in partial profiles and/or where mtDNA processing has not been conducted (e.g., partial STR profile generated in 2005).

Services for SAKI sites provided by UNT:

- FGG for those cases searching properly in CODIS (STRs and Mito) for greater than 6 months with no associations reported to the missing index.
- Collaborate with SAKI sites to ensure cases are reported to relevant databases (NCIC, NamUs, ViCAP, NCMEC)
- Assist SAKI sites with the repatriation of their jurisdiction's Jane/John Doe victims' remains to their loved ones.

UNT Minimum monthly deliverables will be:

- 25 Unidentified Persons (i.e., Jane/John Doe) cases—STRs and mtDNA (300 per year)
- 10 cases for FGG (laboratory work only)—single nucleotide polymorphisms (SNPs) and/or other applicable technologies/methodologies (120 per year)
- 150 Family Reference samples (FRS)—STRs and mtDNA (1,800 per year)
  Note: FRS processing is applicable only when there is a putative identification for a Jane/John Doe, so we anticipate the main focus to be on the processing of remains.

Everyone's story deserves an ending

Thank you!

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