



# Implementing Familial DNA Searching in Virginia



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# Definition

**Familial DNA searching - search of a DNA database to attempt to identify a biological relative (typically a parent, child, or sibling) of the contributor of an evidentiary profile.**

**Performed only after routine direct search of the evidence profile fails to identify a possible contributor in the database.**

**The search is performed using specialized software designed and validated for such purpose.**



# Legal Background

## ■ California and Colorado

- Familial Searching not addressed in state data bank laws
- Set out in California Department of Justice and Colorado Bureau of Investigation policies

## ■ Federal DNA Identification Act

- 42 U.S.C. §14132 is silent as to familial DNA searching



# Virginia Legislation

- Familial searches are not specifically addressed in the Virginia data bank statutes.
- Virginia law clearly authorizes DFS to search the data bank for the purpose of potentially identifying a profile that is consistent with the profile of a DNA sample deposited on an item of submitted evidence. Va Code §19.2-310.5



# Virginia State Crime Commission Considered & Advised

- **Legislative** – Members of legislature consulted: existing VA laws sufficiently address & support familial searches.
- **Legal** opinion from AG's Office: **No VA laws violated** by conducting a familial search.
- **Executive** - Considered gathered info & Sec. of Public Safety instructed DFS to implement.



# Searching a Data Bank for Relatives

- Looking for a partial match that follows genetic inheritance patterns
- As number of profiles in a database increases, familial search will identify more candidates
- Many and possibly all, not biologically related to the donor of the profile found on the evidence
- Applying a Y-STR filter drastically reduces candidate list

# Data Bank Search

Item	Description	FGA	TPOX	D8S1179	vWA	Amelogenin	Penta E	D18S51	D21S11
2	Blood stain	20, 24	8, 12	10	17, 19	X,Y	10, 12	12, 21	28

## Typical DB search

### FGA

20, 24

20

24

## Familial DB Search

### FGA

20, 18      24, 18

20, 19      24, 19

20            24, 20

20, 21      24, 21

20, 22      24, 22

20, 23      24, 23

20, 24      24

20, 25      24, 25

20, 26      24, 26

20, 27      24, 27

20, 28      24, 28

20, 29      24, 29

20, 30      24, 30



# Virginia Database Considerations

- Size (N~330,000)
- Composition (CO & Arrestee)
- Autosomal STR loci (PowerPlex 16)
- Gender (~80% Male)
- Established time span (1989 - present)
  - 1989-1990: sex offenders, then all convicted felons
  - 1996 juvenile offenders
  - 2003 violent arrestees
  - 2006 all registered sex offenders



# Software Options

- **CODIS not designed for familial searches**
- **Purchase \$10,000 to \$500,000**
- **Design your own**
- **Share with another lab system**



# Denver Software

- **Installed at VDFS December 28<sup>th</sup> 2010**
- **Validation**
  - **System**
  - **Import**
  - **Removal**
  - **Historical, partial profiles, and odd profiles from the data bank**
  - **Formulas used**
    - **Allele frequencies**
    - **LR (sibling index, parentage index)**
  - **Run family samples**
  - **Setting thresholds**



# Family Samples

- Make your own
- Randomly generated from a computer program
- Actual family tree data



Forensic ID	Offender ID	Alleles Shared	PI, Cauc	PI, Hisp	PI, AfroAm
ANDREW_D-38	ANDREW_D-38	30	445630876	650059442	70650159761
ANDREW_D-38	STEVE_D-35	18	568275.78	1399587.9	31670142.57
ANDREW_D-38	ADDISON_D-28	18	468090.74	1273681.1	131651917.2
ANDREW_D-38	SUSIE_D-34	17	240260.99	907920.71	69688943.43
ANDREW_D-38	Felon	18	45345.981	38563.847	307427.5819
ANDREW_D-38	Felon	17	31210.912	92776.354	865497.0536
ANDREW_D-38	Felon	15	21669.092	86945.356	1216847.349
ANDREW_D-38	Felon	18	8801.7737	47580.86	940495.5008
ANDREW_D-38	Felon	14	4394.6246	18543.454	269275.2665
ANDREW_D-38	Felon	16	2744.6084	20453.985	122698.5569
ANDREW_D-38	Felon	14	2189.9721	28785.825	322934.8127
ANDREW_D-38	Felon	15	1455.6897	3588.1538	12230.2674
ANDREW_D-38	RUSS_D-1	19	1030.0984	940.77907	112971.2378
ANDREW_D-38	TIM_D-26	16	888.87123	2836.7635	258284.9573
ANDREW_D-38	Felon	15	172.72826	2652.5937	114713.3452
ANDREW_D-38	CEC_D-18	17	51.30567	103.67636	9664.845233



# Lineage Testing: Virginia

Test ranked candidates in 3 population groups  
(Caucasian, Black, Hispanic)

- Top 15 parent-offspring
- Top 50 sibling
- 195 samples
- Remove duplicates
- Remove Females
- Y-STR testing on about 100 samples



# Capture Rates

## Percent Ranking

	top 10	top 15	top 20	top 50	top 80	top 100
Parent-Offspring	85.23	89.93	93.29	-	-	-
Sibling	-	-	-	81.44	83.51	86.60



# Implementation: Key Ingredients

- **Software**
- **Staff training and proficiency testing**
- **Lineage testing**
  - **YSTR**
- **What cases to accept**
- **Dissemination of information**



# Case Acceptance

- Violent crime against a person
- Investigative leads have been exhausted and critical public safety concerns remain
- Single-source DNA profile
- Complete or nearly complete DNA profile
- Commit to further investigation if potentially related individuals are identified



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### POLICY RELATING TO ACCEPTANCE OF CASES FOR PERFORMANCE OF FAMILIAL DNA SEARCHING

#### Background

The Virginia Department of Forensic Science ("DFS") has the capability to perform a Familial Search of DNA profiles maintained in the Virginia DNA data bank. The application of familial DNA searching may result in the provision of investigative information to law enforcement officials in unsolved cases in which other investigative leads have been exhausted.

A familial search is a deliberate search of the Virginia DNA data bank for biologically-related relatives (siblings, parents, and children) of a contributor of an evidentiary profile. This search is performed with specialized software designed and validated for such purpose. The information that may develop from a familial search and ultimately be provided to law enforcement will be the name or names of an individual or individuals in Virginia's DNA data bank who may be related to the person whose DNA was identified on crime scene evidence.

The process associated with familial DNA searching requires special DNA testing and, possibly, a law enforcement investigation of the potential relative. Accordingly, DFS's policy on case acceptance for this process was developed taking into consideration both privacy concerns and agency resources, recognizing that it may provide information useful for identifying the perpetrator of a violent crime against a person, thus preventing further victimization.

Pursuant to its authority under §§ 9.1-1100 and 9.1-1101 of the *Code of Virginia*, and by request of the Secretary of Public Safety pursuant to § 2.2-200 of the *Code of Virginia*, the Department establishes the Policy that follows as its policy relating to the acceptance of cases appropriate for the performance of familial DNA searching.

Virginia's DNA data bank, first established in 1989, currently consists of (i) a database of DNA profiles developed from samples provided by persons convicted of certain criminal offenses, (ii) a database of DNA profiles developed from samples provided by persons arrested for the commission or attempted commission of certain violent felonies or other specified crimes, (iii) a database of DNA profiles from deceased victims, (iv), a database of DNA profiles from unidentified human remains, (v) a database of DNA profiles from missing persons, (vi) a database of DNA profiles from individuals who are registered with the Virginia Sex Offender and Crimes Against Minors Registry and (vii) a database of DNA profiles developed from crime scene evidence. The databases together form the Virginia DNA data bank.



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### AGREEMENT RELATING TO REQUEST FOR FAMILIAL DNA SEARCH

In furtherance of the criminal investigation relating to FS Lab #: \_\_\_\_\_, the Director of the Department of Forensic Science (DFS) is requested to direct that a Familial DNA Search of the convicted offender and arrestee indices of the Virginia DNA data bank be conducted. Pursuant to the DFS Policy Relating to Acceptance of Cases for Performance of Familial DNA Searching, we confirm that the following criteria have been satisfied:

1. The chief law enforcement officer of the investigating law enforcement agency requests the Department of Forensic Science to perform a Familial DNA Search in this case;
2. this case relates to an active investigation of an unsolved violent crime against a person;
3. all other investigative leads have been exhausted and critical public safety concerns remain;
4. prior analysis of crime scene evidence has yielded a single-source DNA profile(s) or a deduced single source profile from a DNA mixture which when traditionally searched against other data bases at the state or national level has not developed any useful results;
5. the crime scene evidence exhibits a full DNA profile or partial DNA typing results that may be suitable for familial search purposes;
6. the Director of DFS, the DFS Biology Program Manager, the requesting chief law enforcement officer, the Commonwealth's Attorney for the investigating jurisdiction, and any other personnel deemed necessary shall have conferred regarding this request, the case criteria, and the use of any search results; and
7. the chief law enforcement officer of the investigating law enforcement agency and the Commonwealth's Attorney for the investigating jurisdiction agree to further investigation if an individual or individuals potentially related to the contributor of the evidence DNA profile is/are identified.

#### *Requesting Chief Law Enforcement Officer:*

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Title: \_\_\_\_\_ Dept./Jurisdiction: \_\_\_\_\_

#### *Commonwealth's Attorney:*

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Jurisdiction: \_\_\_\_\_

#### *Agreed:*

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Director, Department of Forensic Science



# Familial Searching

Once case has been accepted...

- Evidence to be resubmitted for Y-STR analysis
- Search of the previously generated STR profile in the Familial Search program



# Disseminating Results

- Most likely eliminations
  - Repeat search
- Match - investigative lead
- Review of vital records to eliminate
- Alternate reference samples
- Samples NOT taken from every male relative in the family



# Disseminating Results

- Not eliminated - reference sample for a direct comparison to evidence
- Reference samples are not retained in data bank



# Reporting as Investigative Lead

- Named individual **is not the source** of the forensic unknown DNA profile.
- The DNA results provide an **indirect association, based on potential genetic relationships**, rather than a direct match.
- This search **does not confirm** that the named individual is **biologically related** to the source of the forensic unknown.
- While DNA results are **best explained by** a parent-child [full sibling] relationship, **other familial relationships could also explain** these results.
- **Other patrilineal relatives** of the named individual, and/or of the source of the forensic unknown profile, are **expected to have the same Y-STR haplotype**.

Report phrasing suggestions generously provided by Cal DOJ.



# Reporting a Negative Result

Search did not identify any potential relatives of the source of the evidence profile.

- This result does not preclude the **possibility that such a biological relative may exist in the database**; however, identification of that relative through our existing methodology was not feasible.
- Alternatively, **no such relatives may exist in the database.**
- **Future Familial Search** of the Database may be conducted, upon written request from your agency, **no sooner than 12 months** from the date of this CoA.
  - VA Adds ~ 2,500 offender samples per month
  - Routine direct match searches continue weekly

Report phrasing suggestions generously provided by Cal DOJ.



# Female Samples from Data Base

- Female samples are not considered currently in Virginia Familial searches
- Va. Data Base approximately 20% female
- Mito Screening?



# Acknowledgements

- Denver District Attorney's Office
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# Questions