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# An Evaluation of Six Buccal Sample Collection Products for Database Profile Generation

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February 25, 2011

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# Who we are...



- Private forensic DNA laboratory (ASCLD/ISO accredited) offering full serological and DNA testing services



- Chemistry and instrument validation
- Bio-technical services

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# DNA profile databases...a valuable tool in criminal investigations

- Often important new “leads” generated when DNA profile generated from a crime scene produces a “hit” when compared against known offender profiles in a local or national database.
- According to Bureau of Justice Statistics, fifty-six percent of the violent felons convicted in the 75 most populous counties from 1990 through 2002 had a prior conviction.
- Globally, 16.5 M profiles in 54 national databases \*
- In the United States, as of December 2010, CODIS has produced over 134,500 hits assisting in more than 129,500 investigations.  
[www.fbi.gov/about-us/lab/codis/ndis-statistics](http://www.fbi.gov/about-us/lab/codis/ndis-statistics)

\* Interpol Global DNA Profiling Survey, 2008.

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# Different collection products and processing methods...

Reference sample collection (Buccal cells)

## Collection product formats

- Swabs
- Untreated paper
- Foam applicators and treated-paper  
(chemically impregnated)

## Processing methods

- Organic DNA extraction
- Punch-IN STR PCR
- Direct STR PCR

# Buccal sample collection products....

Swabs

Cotton swab (Puritan®)



OmniSwab (GE/Whatman®)

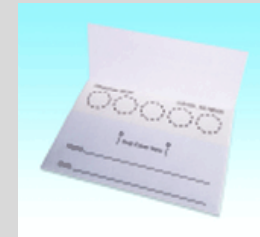


Untreated

BodeCollector™ (Bode Technology)



903 cards (GE/Whatman)



Treated

EasiCollect (GE/Whatman)



FTA® indicating cards (GE/Whatman)



## Study

Compare DNA quantity, quality, work-flow time and ease-of-use for 6 collection products and 3 methods -

2 phases:

- Preliminary study performed using 3 donors (n=3) 9 samples
- Full study performed using 30 donors (with direct workflow)

Methods:

- Organic DNA extraction – In House extraction method
- Punch In STR PCR – Identifiler (Applied Biosystems)
- Direct STR PCR – Identifiler Direct (Applied Biosystems)

# Methods - Experimental procedures

## ORGANIC

Organic Extraction



DNA Quantification



DNA Normalization



STR PCR

**EasiCollect, FTA, 903,  
Bode, Swab, OmniSwab**

## PUNCH IN

Punch out disc (1.2mm)



Wash and dry



STR PCR

**EasiCollect, FTA, 903**

## DIRECT

Punch out disc (1.2mm)



STR PCR

**EasiCollect, FTA, 903,  
Bode\***

qPCR chemistry – Quantifiler Human  
STR chemistry – Identifiler, Identifiler Direct (AB)

All samples processed with 3130xL genetic analyzer and analyzed using GeneMapper IDX (AB).

\* Additional reagent incubation step required for direct workflow

# Results: Preliminary Study - Organic Extraction

## qPCR data (Quantifiler Human)

	Collection Product	Average Total Yield (ng/ul)	STDEV	Average Total Yield (ngs)	STDEV
(~2mm <sup>3</sup> cut)	<b>Swabs</b>				
	Cotton Swab	33.50	3.98	2763.45	1224.03
	OmniSwab	36.28	6.27	2328.04	796.69
(3mm punch)	<b>Untreated</b>				
	Bode	0.74	0.52	37.10	12.40
	903 plus foam applicator	0.88	1.00	44.10	5.70
	<b>Treated</b>				
	EasiCollect	0.51	0.05	53.80	21.50
	FTA plus foam applicator	0.86	0.27	43.10	22.60

**Sufficient DNA quantity & concentration obtained from all products to generate full STR profile.**

# Results: Preliminary STR-profiling results for 6 collection products & 3 processing methods

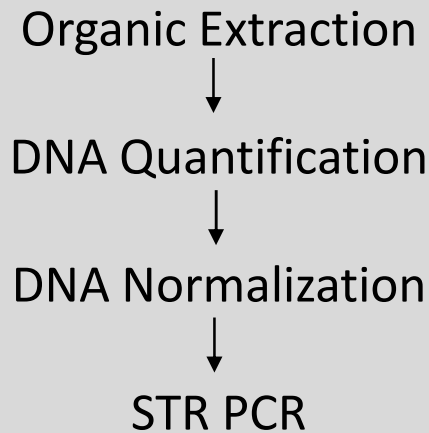
Collection Product	Organic		Punch In		Direct	
	Success Rate (%)	Average Peak Height	Success Rate (%)	Average Peak Height	Success Rate (%)	Average Peak Height
<b>Swabs</b>						
Cotton Swab	100	781	ND	ND	ND	ND
OmniSwab	100	901	ND	ND	ND	ND
<b>Untreated</b>						
Bode	100	924	ND	ND	100	780
903 plus foam applicator	100	494	56	760	56	247
<b>Treated</b>						
EasiCollect	100	2266	89	1193	100	1717
FTA plus foam applicator	100	881	100	925	100	1133

**‘Treated’ collection products gave higher first-pass full DNA-profile success rates & greater peak heights than ‘un-treated’ products.**

**All PHR >60%**

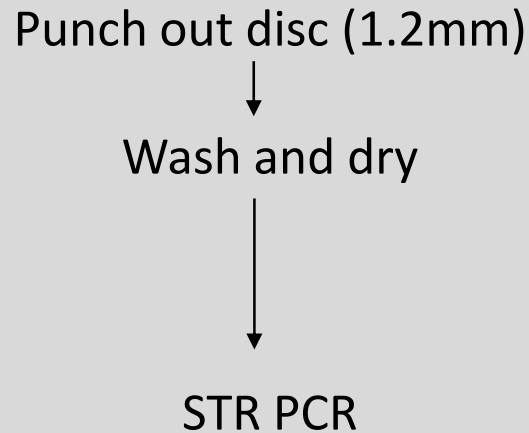
# Results: Work Flow comparison: DNA prep time

## ORGANIC



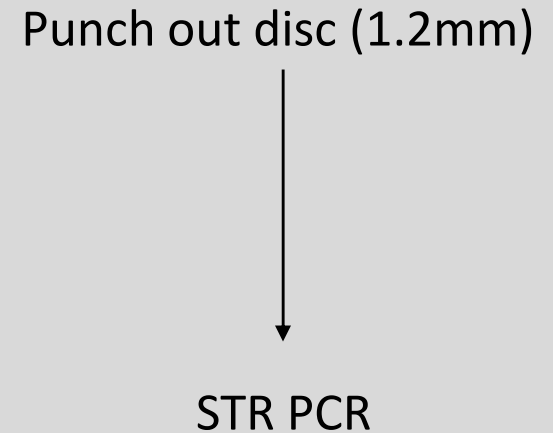
EasiCollect	}	4 hours
FTA		
903		
Bode		

## PUNCH IN



EasiCollect	}	60 mins
FTA		
903		

## DIRECT



EasiCollect	}	4 mins
FTA		
903		
Bode*		26 mins

\*Additional reagent incubation step required for direct PCR

# Results: Full Study – Direct Method (30 Donors)

Collection Product	#Full profiles/Total	Average Peak Height	STDEV
<b>Untreated</b>			
Bode*	30/30	922	400
903 plus foam applicator	11/30	366	652
<b>Treated</b>			
EasiCollect	29/30	764	640
FTA plus foam applicator	29/30	1252	974

\* additional reagent and time required to achieve

## Total Treated vs. Untreated

Collection Product	#Full profiles/Total	Success rate %	Av Peak height
<b>Untreated</b>			
903 plus foam applicator	16/39	41%	306
<b>Treated</b>			
FTA plus foam applicator	38/39	97%	1192

# Conclusions:

- Irrespective of the buccal sample collection product used, routine organic extraction reliably provided DNA of sufficient quantity & quality to produce STR profiles suitable for database-upload (according to CODIS requirements). However, this method was laborious and time consuming
- ‘Treated-paper’ sample collection products coupled with Direct-PCR STR workflows provided DNA profiling results equivalent to organic extraction
- When using punch-in or direct-PCR workflows, sample collection devices containing ‘treated’ papers provided higher first-pass full-profile success rates than untreated paper (903)
- Direct-PCR STR workflows coupled with ‘treated-paper’ sample collection products provided:
  - ✓ Good first-pass full DNA profile success rates
  - ✓ Rapid processing times (4 minutes with EasiCollect-FTA)
  - ✓ Minimal processing steps (punch and PCR)
  - ✓ Ideal workflow for high-throughput automation

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# Acknowledgements:

Sorenson Forensics LLC

Brian Fiedler, Craig Nolde, Dan Hellwig,

Briana Smalling, Carrie Pedersen, Ryan Buchannon.

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# Questions?

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