

Chicken or the Egg: Process for Latent Prints or DNA First?

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Background

- At the time of the project, the DNA section was seeking out strategies to streamline their processes and reduce backlog¹
- Requests for latent print work and DNA analysis on same evidence increased
- The latent print section was operating with a limited backlog - had to take swabs first or wait for DNA to finish

Background

- Studies indicate that porous items processed for prints first still yield DNA results^{2, 3}
- These studies were carried out primarily with petroleum ether and acetone formulations of DFO and ninhydrin as opposed to HFE-7100

Influencing Factors

- Focus on one type of evidence: porous
 - Typically no obvious place to swab
 - Looking for touch DNA as opposed to a stain
- Who should process the evidence first?
 - Will swabbing for DNA damage the prints?
 - Will latent print processing negatively affect DNA?
- What approach allows for more efficient workflow?

The Team

Latent Print Section

- Karley Hujet
- Diana Tabor

DNA Section

- Margaret Ewing
- Michelle Rusch

Project Design



Porous materials

- Copier paper
- White envelopes
- Manila envelopes
- Cardboard
- Glossy (magazine) paper
- Photo (inkjet) paper

Latent Print Processing

- DFO in HFE 7100 formula
- Ninhydrin in HFE 7100 formula
- DFO followed by ninhydrin

Sample Collection

- Two subjects used
- The subjects used were known to leave good prints on porous items
- The intent of the print deposition was to emulate a “touch DNA” situation
- Hand was placed on substrate, outline drawn, substrate cut in half

Sample Collection

6 substrates

x

2 subjects

x

3 fingerprint methods

x

2 DNA extraction types

x

2 processing order

144 samples

Sample Processing

- Each Identification and DNA analyst worked with substrates from only one donor throughout the project
 - The main goal was to minimize cross-contamination
 - Consistency

DNA Processing

- Sterile swabs were moistened with 30 μ l of sterile water
- DNA first - swabbed entire area of paper
- Prints first - swabbed marked areas of latent print development
- Prints first - some samples were cut instead of swabbed

Latent Print Processing

- Paper items sprayed with DFO or ninhydrin
- DFO - 20 minutes at 100°C
- Ninhydrin - 20 minutes at approx. 60°C and 40% humidity

Latent Print Processing

- DFO in HFE 7100 formula
- Ninhydrin in HFE 7100 formula

Latent Print Processing

- For prints that were processed before DNA, the oven was wiped down with 10% bleach solution
- When DNA was second, prints were transferred to DNA section the same day as latent print processing.

Latent Print Processing

Visualized DFO prints with
Coherent's TracER laser at
530 nm

DNA methods

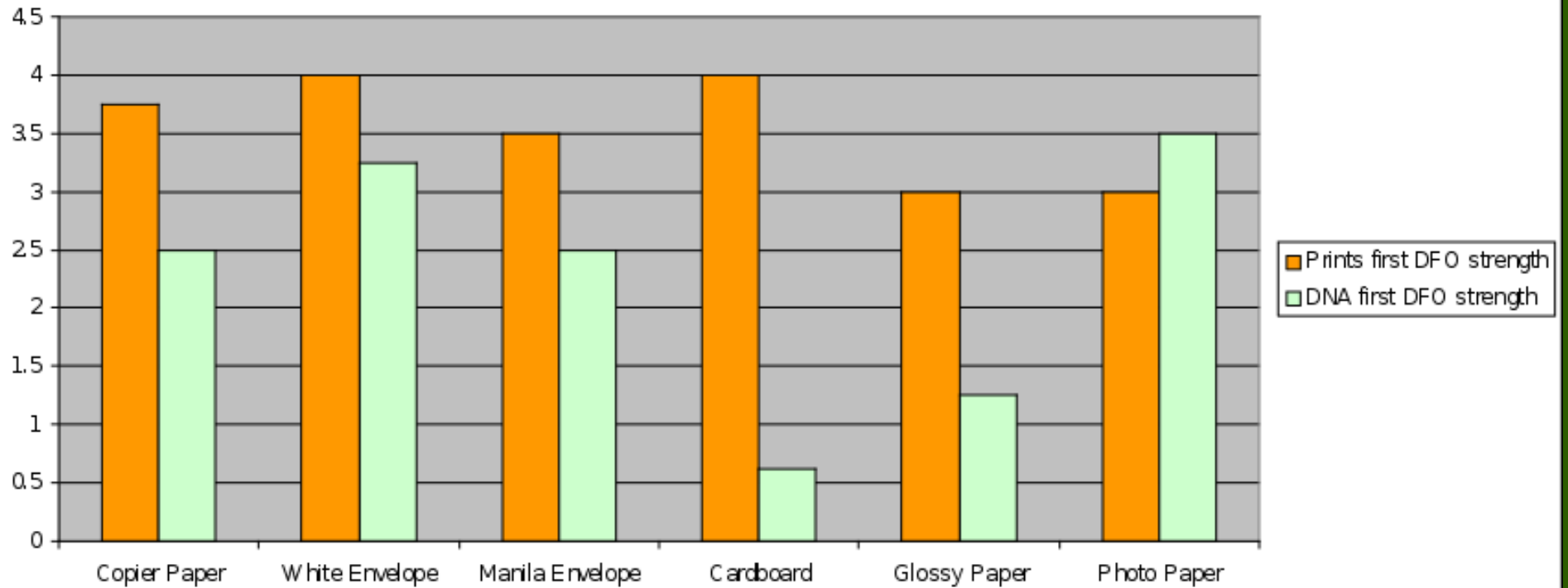
- Sample collection
 - Swabbing (swab moistened with 30 μ l of sterile water followed by dry swab)
 - Cutting
- Extraction techniques
 - Organic
 - IQ (robot)

Test Set #1:

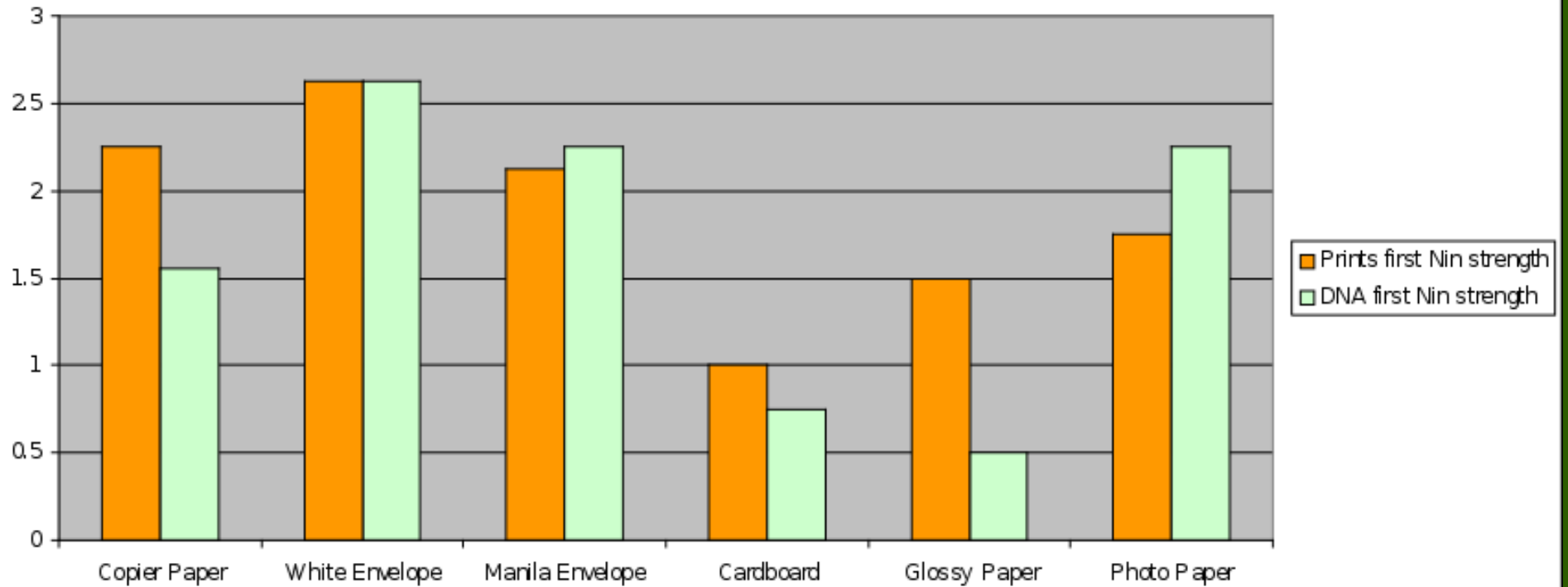
DNA □ Fingerprints

- DNA swabbed the entire top and bottom surface of substrate ignoring outline of palm (mimic real casework—no knowledge of print location)
- Ident then processed with DFO, Ninhydrin, or DFO + Ninhydrin
- Evaluation of strength and clarity of prints

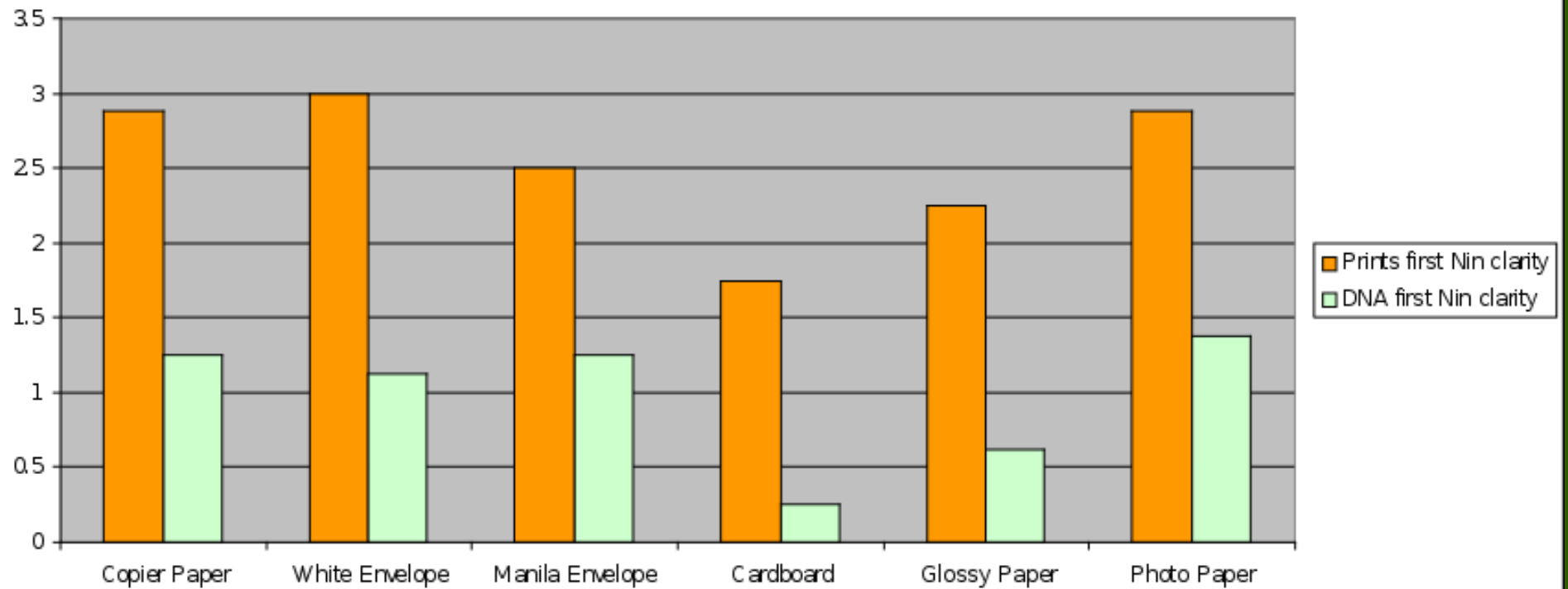
DFO strength comparison



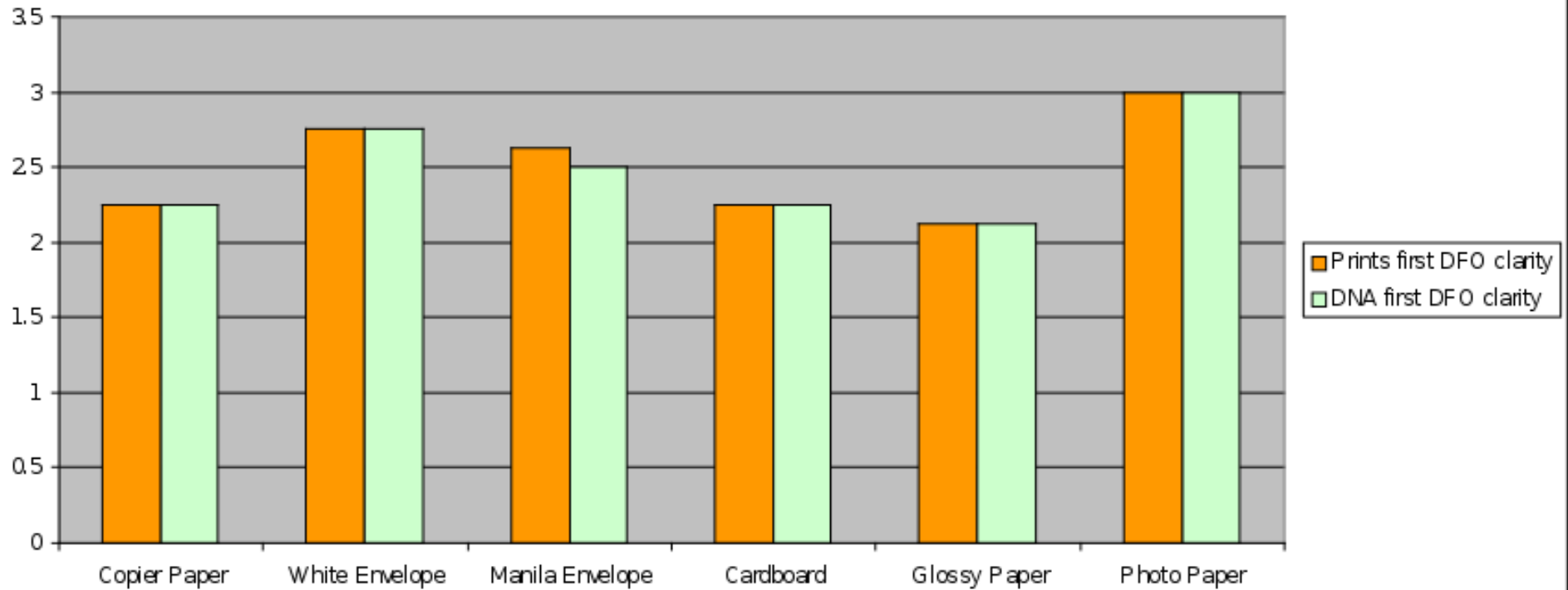
Ninhydrin strength comparison



Ninhydrin clarity comparison



DFO clarity comparison



Test Set #2:

Fingerprints □ DNA

- Swabbed areas with developed prints (fingerprint analysis used as a screening tool)
- 3 samples of each substrate were extracted organically or with IQ (robot) per donor



Prints developed first

O2 – cardboard treated with ninhydrin

O3 – cardboard treated with DFO + ninhydrin

Test Set #3:

Fingerprints □ DNA

- Cut out areas with developed prints (fingerprint analysis used as a screening tool)
- Test Set #3 added to see if cutting could increase DNA recovery and specificity – additional samples
- 3 samples of each substrate were extracted organically or with IQ (robot) per donor

Conclusions

- Many samples yielded no detectable profile (0 alleles)
 - DNA 1st
 - Donor 1: 6 out of 36
 - Donor 2: 11 out of 36
 - Fingerprints 1st followed by swabbing
 - Donor 1: 10 out of 36
 - Donor 2: 12 out of 36
 - Fingerprints 1st followed by cutting
 - Donor 1: 29 out of 36
 - Donor 2: 26 out of 36

Conclusions

- Many samples resulted in partial profiles (alleles not observed at all loci)
 - DNA 1st
 - Donor 1: 18 out of 36
 - Donor 2: 21 out of 36
 - Fingerprints 1st followed by swabbing
 - Donor 1: 25 out of 36
 - Donor 2: 22 out of 36
 - Fingerprints 1st followed by cutting
 - Donor 1: 7 out of 36
 - Donor 2: 8 out of 36

Questions during project

- Will cutting for DNA after fingerprint analysis affect DNA yield and increase specificity? Could we be losing DNA with swabbing?
- Cutting out all visible prints increased the failure of DNA profile detection
 - Too much substrate per extraction?

Conclusions

- Partial profiles covered a broad range from 1 allele detected to only missing data at one locus
- No further evaluation of the partial profiles has been done at this time

Conclusions

- Samples that yielded complete profiles were mixtures (complete profile defined as alleles observed at all loci)
 - DNA 1st
 - Donor 1: 12 out of 36
 - Donor 2: 4 out of 36
 - Fingerprints 1st followed by swabbing
 - Donor 1: 1 out of 36
 - Donor 2: 2 out of 36
 - Fingerprints 1st followed by cutting
 - Donor 1: 0 out of 36
 - Donor 2: 2 out of 36

Conclusions

- Shedder status did not affect ability to leave prints
- # of samples with complete DNA profiles (alleles below LIT, but alleles at every locus) was small
 - Observed more specific profiles when DNA testing performed after fingerprint analysis & specific prints were targeted for extraction

Who should process the evidence first?

DNA First

- More alleles were detected when DNA was collected first
 - All profiles were low level & not suitable for inclusion
- Limited amount of water does not appear to interfere with latent print development

What approach allows for the more streamlined workflow?

DNA First

- DNA section accustomed to sterile techniques
- If latent print processing is second, less opportunity for DNA contamination

What approach allows for the more streamlined workflow?

Prints First

- For the ink jet photo paper, DNA results were better when prints were processed first
- In cases where the area to swab is very large, it may help to have prints developed first to narrow down the touched areas
- More specific DNA profiles were developed when Identification went first

Case work results

- After preliminary results from this project, most cases were swabbed by DNA first and then processed for prints
- Cases were reviewed to see if prints and/or DNA had been developed on porous items submitted for both sections

Case work results

- For the purposes of this project, a case was considered to have prints if the report stated there were prints suitable for comparison

Case work results

- For the purposes of this project, a case was considered to have DNA if the report indicated there were profiles developed
 - A change in the manual's protocol did occur – some of the earlier cases may have been excluded later on due to a change in reporting procedures
 - Complete profiles have been developed in casework

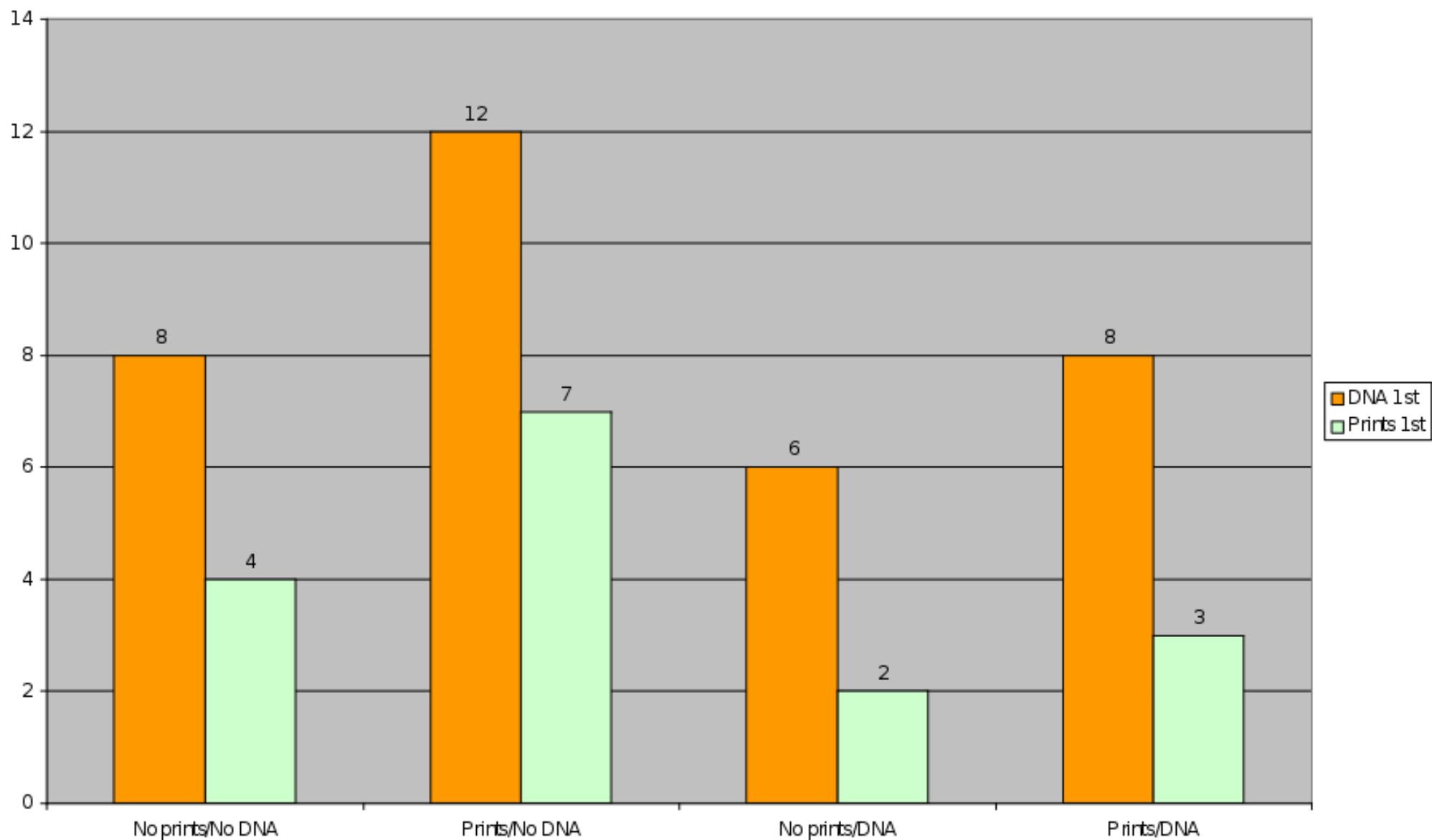
Casework Results

2008 – present

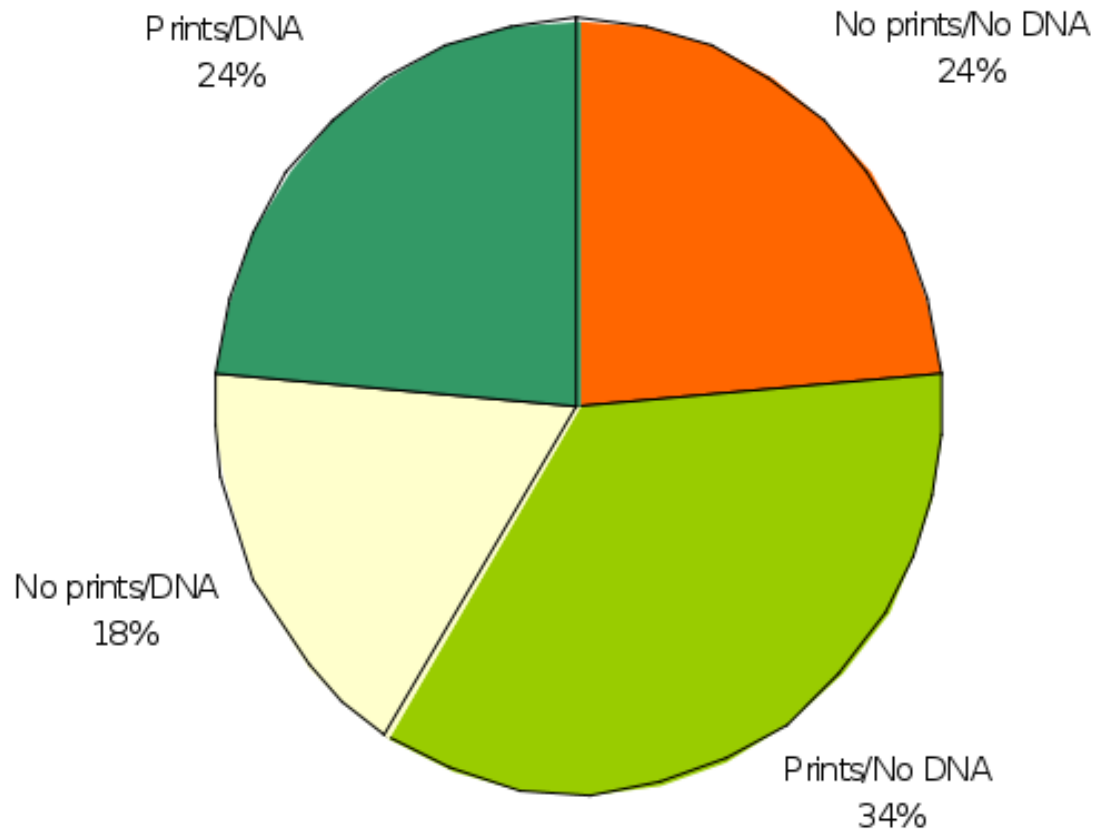
Once the project was well underway and showed no adverse affects on latent prints, DNA has generally processed evidence first.

The following charts represent 50 cases in which porous evidence was processed for prints and DNA at the laboratory.

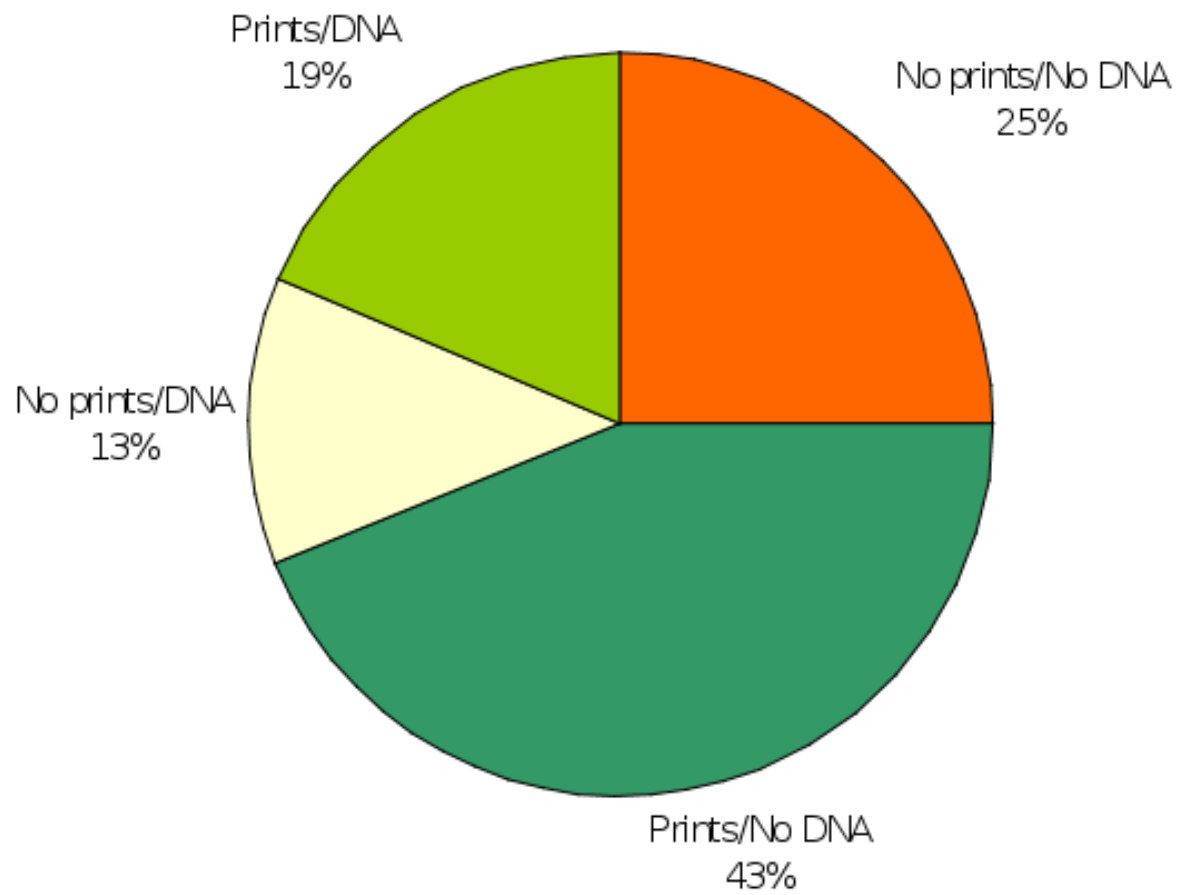
Who Goes First?



Casework: DNA 1st
n=34



Casework: Prints 1st
n = 16



What's next?



Future Projects?

- Try swabbing for DNA and developing prints on paper that has been handled (opposed to just touched)
- Try using the cutting method again, but use less material per extraction
- Would there be a difference using photo paper with photos (ink deposited on paper)?
- Could try swabbing entire paper for DNA □ prints □ cutting out prints for DNA
- Exploring how often touch DNA does not match the fingerprint where the DNA was collected

References

1. Review of State Crime Lab Resources for DNA Analysis (WI DOJ) <http://www.doj.state.wi.us/news/files/dnaanalysisplan.pdf>
2. Presley, L.A.; Baumstark, A.L.; Dixon, A. The Effects of Specific Latent Fingerprint and Questioned Document Examinations on the Amplification and typing of the HLA DQ alpha Gene Region in Forensic Casework. *J For Sci* 1996; 41(6), 1012-1017.

References

1. Grubwieser, P.; Thaler, A.; Köchl, S.; Teissl, R.; Rabl, W.; Parson, W. Systematic Study on STR Profiling on Blood and Saliva Traces after Visualization of Fingerprint Marks. *J Forensic Sci* 2003; 48(4), 733-741

Access on the web

website:

Thank you

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