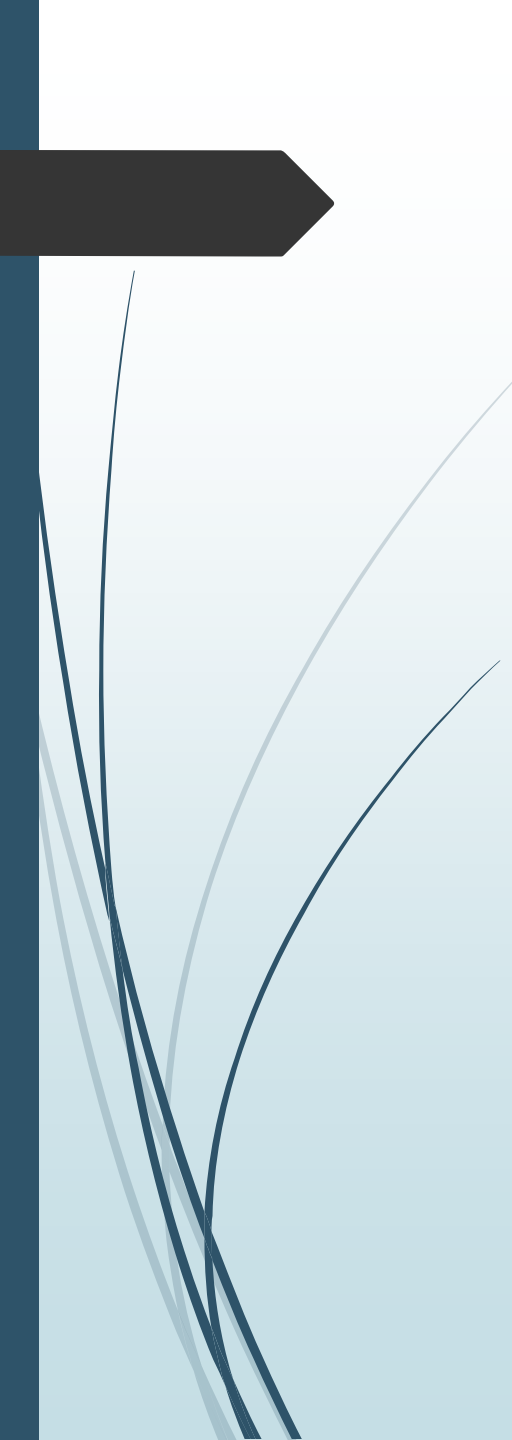




Automation of the Differential Digestion Process for Sexual Assault Kit Evidence

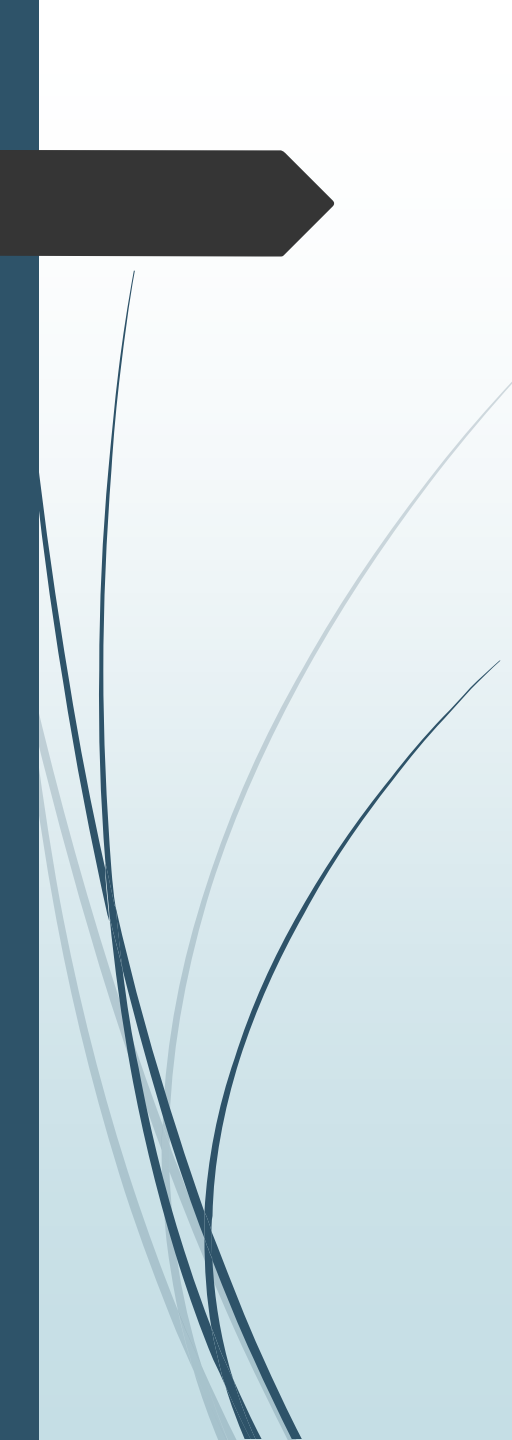
Helena Wong

Oakland Police Department Crime Laboratory



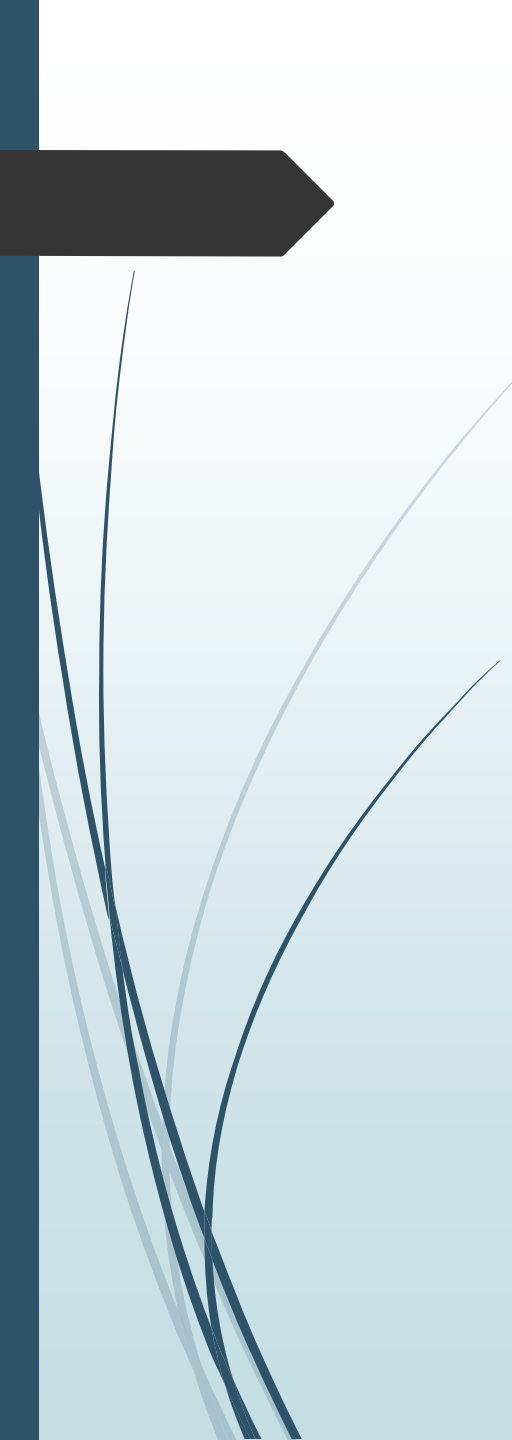
Sexual Assault Evidence

- Sexual Assault Evidence Kits
 - Collected by trained nurses at local hospitals
 - Swabs of body orifices, body surfaces, fingernail scrapings, underwear
- Submission of kits to Police Departments
 - Only kits that have been requested to be tested will be examined by the crime lab
- Sexual Assault Kit Backlog
 - Many police departments have a large number of kits that have not been tested
 - Few hundreds upwards to thousands of kits



Tackling the Sexual Assault Kit Backlog

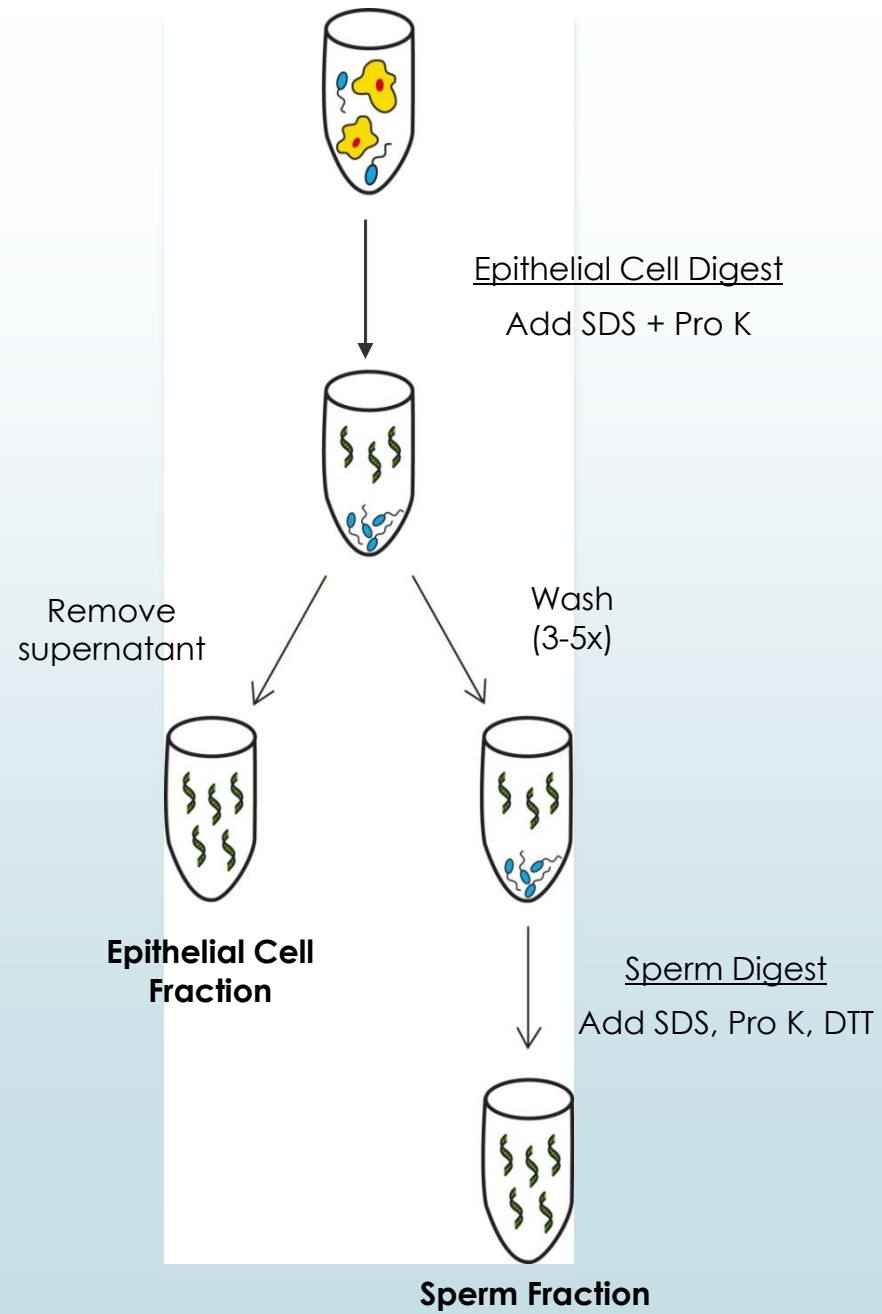
- National attention and focus on reducing the sexual assault kit backlog
- How can crime labs accommodate this request?
 - Hire more analysts
 - Limited money, funding, and space?
 - Transition to automated processes
 - Higher efficiency
 - Higher throughput
 - Saves time

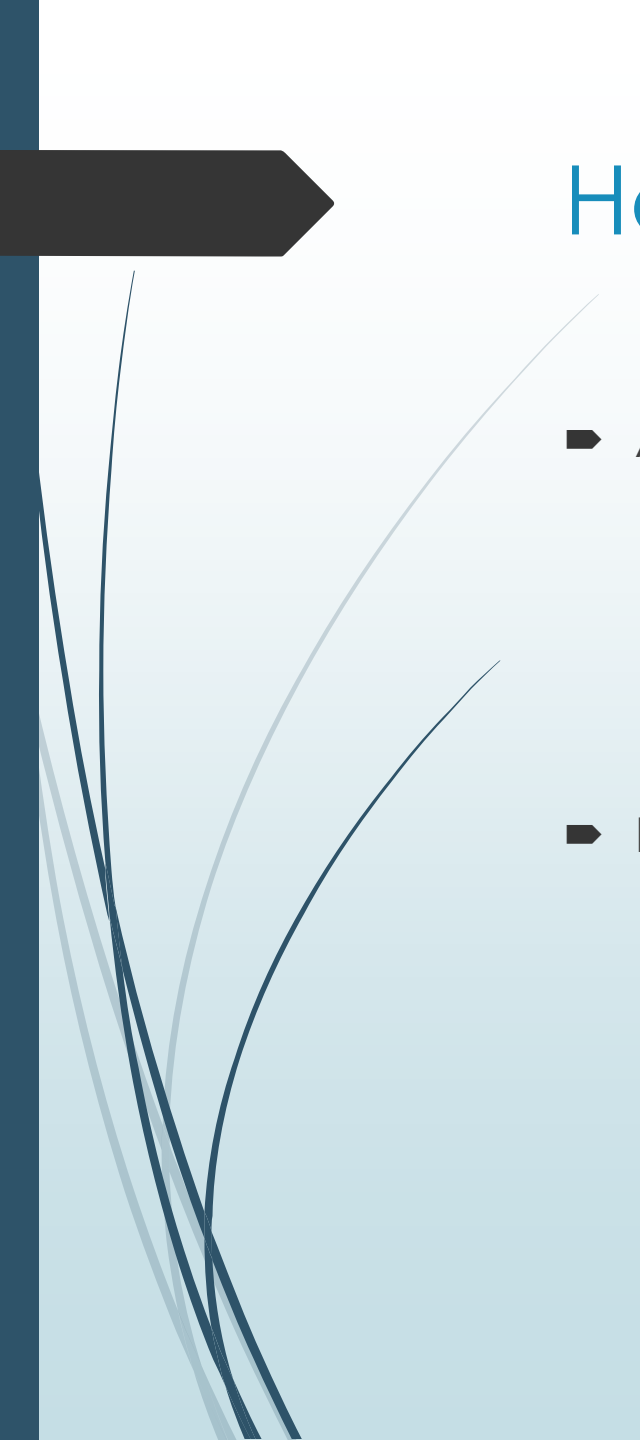


Differential Digestion

- Many processes in DNA analysis have already been automated, except the differential digestion process
- All sexual assault evidence must undergo the differential digestion process
 - Separates sperm cells from non-sperm cells (epithelial cells)
- Time consuming process
 - Labor intensive
 - Difficult to automate

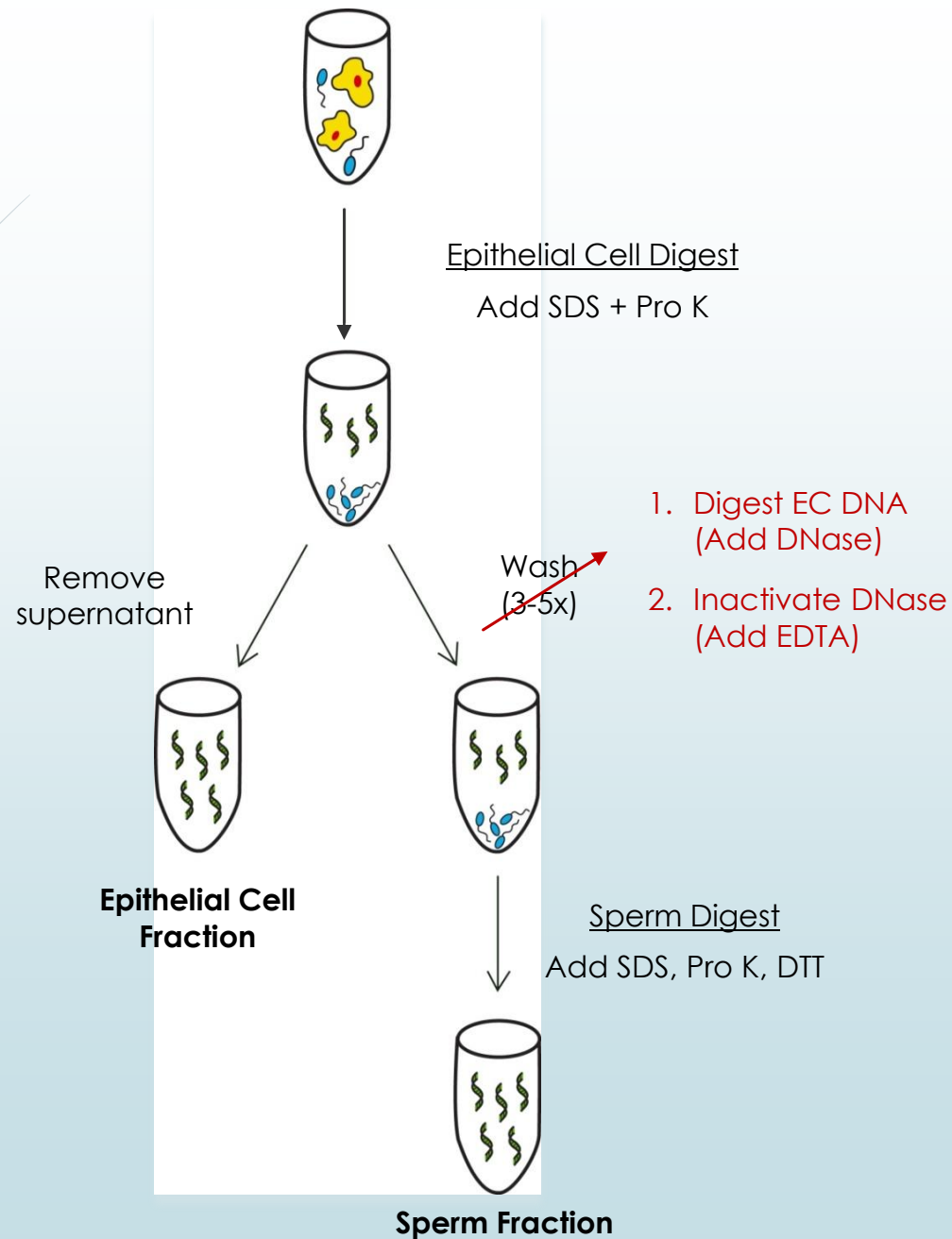
DIFFERENTIAL DIGESTION





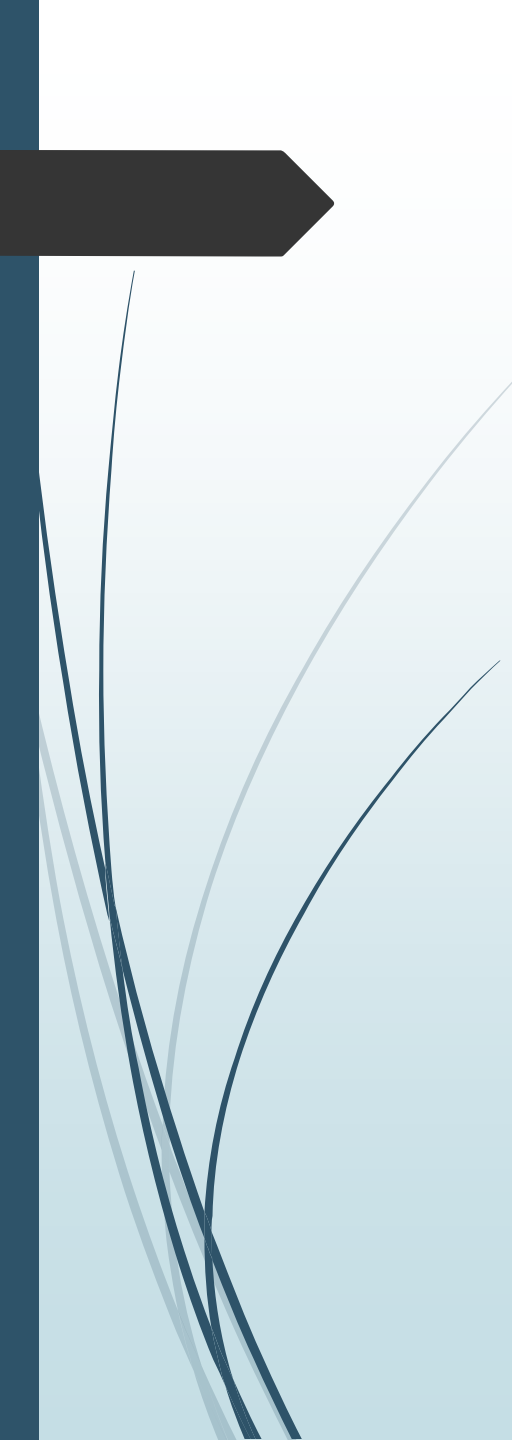
How to Modify this Process

- Automate
 - Eliminate wash & centrifugation steps
 - Eliminate manual steps
 - Increase throughput by going from single tubes to 96-well plates
- Keep the ability to make microscope slides
 - Confirm the presence of sperm



Selective Degradation

- Uses a degradative agent to eliminate residual epithelial cell DNA
 - DNase I
- Replaces wash & centrifugation steps
 - Amenable to automation



Validation Study

- Maintain quality and quantity of DNA as compared to conventional method
 - Similar DNA yield and DNA typing results
- Degraded samples
 - Age, heat, humidity etc.
 - Does DNase cause any negative impact?
 - Tested semen stains dating back to 1952
 - Similar results between samples process with and without DNase

Aged Semen Stains

1985

A – with DNase
B – without DNase

Frozen



Room Temperature



Scaled to 2000 RFUs

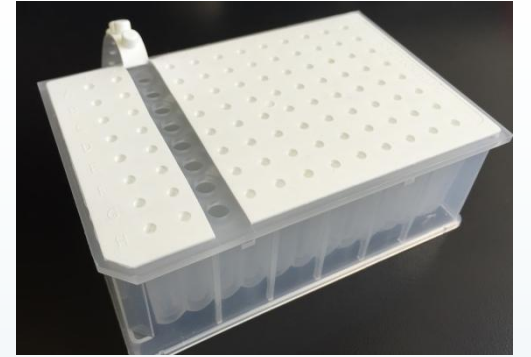
VERSA 1100 Liquid Handler (Aurora Biomed)

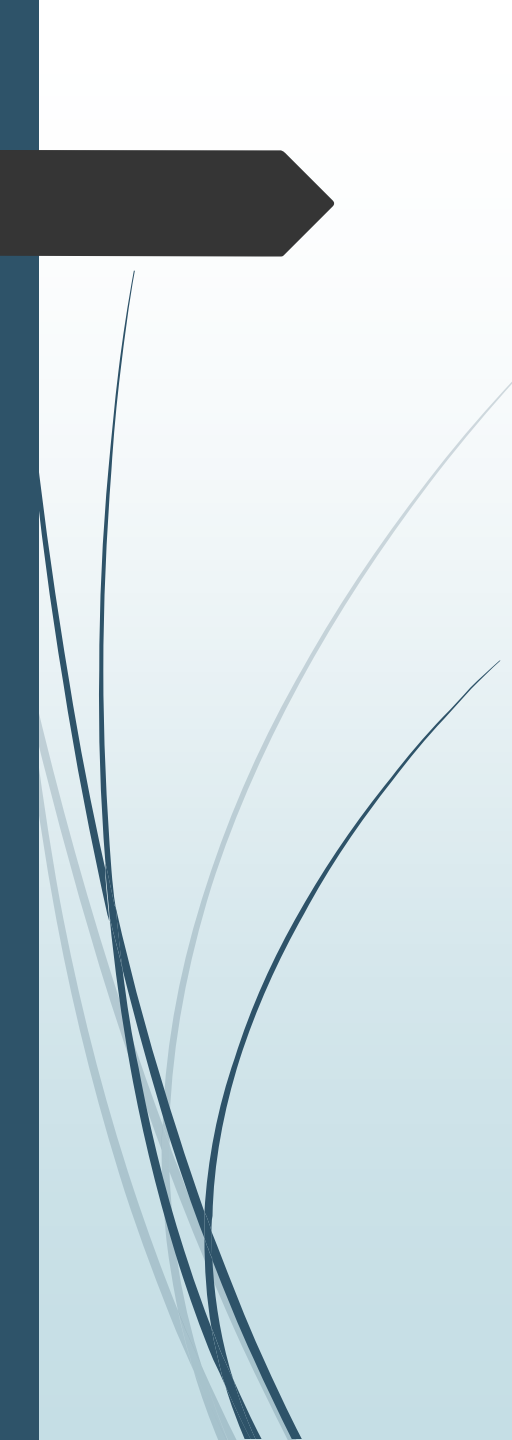
- 15 deck positions
- 4-channel pipettor head
- Includes a Reagent Drop system for fast and easy liquid handling
- Includes an on-deck heater/shaker unit
- Includes a gripper to move plates from one position to another
- Has the ability to prepare microscope slides



Implementation

- Take half a swab and carefully place it in a 96-well plate
- Use septa mat to cover plate during sampling to prevent contamination
 - Can be cut into strips to allow only one column to be exposed at one time
- 1 case per column
- Extract and quantitate all epithelial cell and sperm fractions
- Look for sperm on microscope slides for only samples with male DNA detected during quantitation





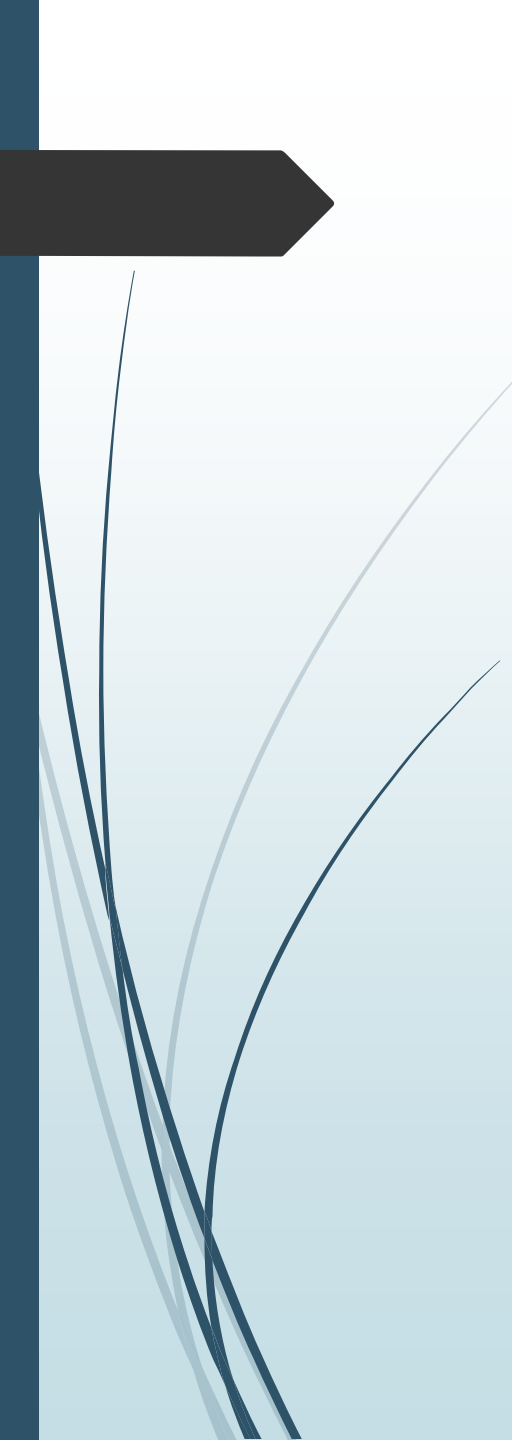
Advantages

- Higher efficiency and throughput
 - 8 hours to differentially digest 96 samples
 - Normally take about 6 analysts to process the same amount of samples in the same amount of time
 - Examine more items
- Minimal hands-on time
- Minimal manual manipulations reduces the chances of contamination and sample switching

OPD Sexual Assault Kit Backlog

- ▶ December 31, 2013
 - ▶ 276 sexual assault (SA) kits – victim & suspect
- ▶ First Round – January 5, 2014
 - ▶ 80 SA kits (victim & suspect)
 - ▶ 4 analysts
 - ▶ 6 weeks
- ▶ Let's get rid of our backlog – April 1, 2014
 - ▶ 196 SA kits (victim & suspect)
 - ▶ 8 analysts
 - ▶ All eligible profiles were entered into CODIS by August 22, 2014
 - ▶ Last report was published in September 2014

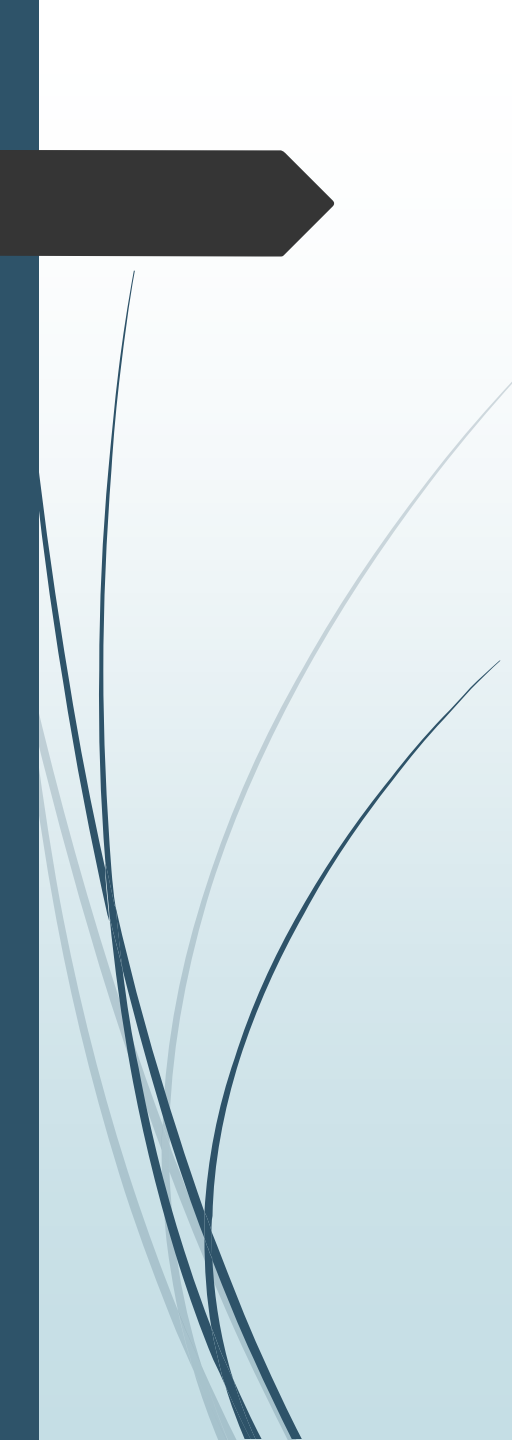




Contemporary Kit Project – May 1, 2014

► Goals

- Analyze every kit submitted to our property & evidence unit
 - Except cases that are deemed unfounded by Special Victims Unit (SVU)
- Kits checked out from property at the beginning of each week
- DNA profile uploaded to CODIS within 10 business days from kit pick-up
- Report to SVU within 20 business days



Status of Contemporary Kits Project

May 1, 2014 – June 1, 2017

- 549 Kits requested
 - 47 Cancelled – by SVU investigators (unfounded, outside jurisdiction)
 - 502 Completed
 - 246 DNA profiles into CODIS (50%)
- **10** days from **receipt** to entry into **CODIS**
- **23** days from **receipt** to publishing **report**
- **20** days from **date of crime** to entry into **CODIS**



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- Aurora Biomed
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Feel free to contact me at:
hgwong@oaklandca.gov
510-238-3386

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Technical Note

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Helena Wong M.S. ✉, Jennifer Mihalovich M.P.H.

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