RapidHIT™ Human DNA Identification System

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Why DNA?

DNA is the “gold standard” biometric tool

- Suspect does not have to be present
- Can be obtained from a wide range of biological materials
- Only trace amounts of material are needed
- Uniquely identifies every individual

DNA is the “gold standard” biometric tool
Rapid DNA Technology Agenda

- FBI Rapid DNA Vision
- How Does the RapidHIT™ Work?
- How Can r-DNA Be Used to Fight Crime?
- How Should r-DNA Be Implemented?
“Advance the state of the art in the collection and processing of known subject DNA. This will provide the Nation’s law enforcement agencies the capability to collect and develop an arrested individual's DNA during the normal time it takes to process a subject at intake. Such processing would initiate a search of the subject’s DNA to determine if it matches evidence from unsolved cases. Rapid DNA will assist in preventing future crimes by expeditiously linking individuals to unsolved cases.”

Joint Statement - FBI/DoD/DHS Rapid DNA Task Force Leadership
How does it work?

RapidHIT™ Human Identification System
Features of a Rapid DNA Device

- Multiple samples run in as little as 90 minutes
- Sample-to-profile capability on automated bench top unit
- Reduced training requirements
- Non-laboratory environment; Transportable – mobile
- Cartridge based with pre-loaded reagents
- NDIS approved extraction, purification and STR reagents
- NDIS approved CE separation and detection techniques
- “Lights Out” Operation
RapidHIT™ – How does it work?
RapidHIT™ - How does it work?
RapidHIT™ - How does it work?

Lab Time

90 minutes

- Cell Lysis/ DNA Extraction
- DNA Quantification
- Dilution
- PCR Amplification
- Detection
- Analysis

RapidHIT™ - How does it work?
RapidHIT™ - How does it work?

The RapidHIT™ Cartridge set

The RapidHIT™ 200 System for Human Identification
RapidHIT™ Consumables

Single Use Cartridge A (Anode Buffer and Polymer)

*EEPROM = Electrically Erasable Programmable Read-Only Memory
RapidHIT™ Consumables

Single Use Cartridge B (Cathode Buffer, Water, Waste Cambers)
RapidHIT™ Consumables

Single Use Sample cartridge

EEPROM

Pneumatic ports for MOVe* valves

4 sample wells

Reagent reservoirs

PCR premix

Reaction chambers

* Proprietary IntegenX Microscale On-chip Valve Technology
RapidHIT™ Consumables

Single Use Control cartridge

- EEPROM
- Pneumatic ports for MOVe valves
- Reagent reservoirs
- PCR premix
- Reaction chambers
- 1 sample well
- 1 allelic ladder
- 1 positive control
- 1 negative control
Fighting Crime With Rapid DNA—
What Can Be Implemented Today
Fighting Crime With Rapid DNA - What Can Be Implemented Today

Reference Samples
- CODIS Hit Confirmation
- Missing Person Reference Samples
- Suspect/Arrestee

Crime Scene Samples - Investigative Lead Development
- Blood
- Saliva
- Semen
Recent RapidHIT™ Performance – Reference sample
RapidHIT™ System Analysis of Blood Samples

Blood samples are found at many crime scenes

- Violent crimes
- Property crimes – burglaries, auto thefts and auto break-ins
- Deceased victims

Blood is challenging

- Heme (from hemoglobin) can interfere with the assay
- The type of substrate can cause problems
  - Certain types of cloth
  - Highly absorbent materials
RapidHIT™ System Analysis of Blood Samples

Adapting the RapidHIT™ for Blood Analysis

New Blood Analysis Protocol

Re-scripting
Slightly longer protocol

Samples from a variety of substrates

Solid surfaces

Wood, metal, concrete, asphalt

Porous surfaces

Cloth, leather, carpet

Implements

Gun, hammer, scissors
RapidHIT™ System Analysis of Blood Samples

RapidHIT Blood Analysis Protocol
Results by Type of Substrate

Investigative Lead Development Threshold

Number of Concordant Loci

Substrate Type

Rusty Scissor Blade
Paper Bag
Metal Hinge
Smooth Concrete
Leather Jacket
Hammer Handle
Untreated Wood
Tennis Shoe
Cloth Car Seat
Knife Handle
Asphalt
Gun Grip
Leather Car Seat
Rough Concrete
Black Denim
Blue Denim
1978 Bloodstain
RapidHIT™  Leather Car Seat

1 Peak Ht Ratio Issue
RapidHIT™ System Saliva-Based Samples

Saliva-based samples from various sources were run using the Enhanced Protocol and Standard Cartridges.
RapidHIT™ Saliva-Based Samples

RapidHIT Saliva-based Samples
Results by Type of Substrate

Number of Concordant Loci

Investigative Lead Development Threshold

Cigarette Butt
Juicy Fruit Gum
Sunflower Seed Shells
Swabbed Spit
Trident Bubble Gum
Coffee Cup Lid
Cinnamon Gum
Water Bottle
Drinking Straw
High Protein Shake Lid
RapidHIT™

Cigarette Butt

[Image of a graph showing genetic analysis results for a cigarette butt sample.]
RapidHIT™ System  Semen Samples

RapidHIT 200

Semen samples can be run using standard HID Protocol and Cartridges
Buccal Swabs and Swabbed Semen Spots (10uL)
RapidHIT™  
Semen/Buccal Mixture Study

Spot and dry semen samples of various volumes
Use a wet 0.33ng 7M Quantitated Swab to swab up samples
Use a wet 1ng 7M Quantitated Swab to swab up samples
Use an interpretation threshold of 500rfu to expertly call alleles

• **Donor 1 : Donor 2**
  • 1uL Semen : 0.33ng 7M Quantitated Swab
  • 2uL Semen : 0.33ng 7M Quantitated Swab
  • 4uL Semen : 0.33ng 7M Quantitated Swab
  • 8uL Semen : 0.33ng 7M Quantitated Swab
  • 16uL Semen : 0.33ng 7M Quantitated Swab

• 1uL Semen : 1ng 7M Quantitated Swab
• 2uL Semen : 1ng 7M Quantitated Swab
• 4uL Semen : 1ng 7M Quantitated Swab
• 8uL Semen : 1ng 7M Quantitated Swab
• 16uL Semen : 1ng 7M Quantitated Swab
RapidHIT™

Semen/Buccal Mixture Study

1uL Semen: 0.33ng Buccal

2uL Semen: 0.33ng Buccal

4uL Semen: 0.33ng Buccal

8uL Semen: 0.33ng Buccal

16uL Semen: 0.33ng Buccal
Conclusions

With the standard cartridges, the RapidHIT System is fully prepared to analyze blood, saliva, and semen based samples to generate investigative leads.

Many different types of substrates are suitable for analysis.

Combined with an effective local DNA database, the RapidHIT provides “near instantaneous” discovery of investigative leads.
Implementation Process
A vision for Rapid DNA Deployment
as an Investigative Lead Development Tool
Implementation – “Hub and Spoke”
Implementation – Local Database

Without a database, a Rapid DNA unit is meaningless. However, with a database, it’s a game-changer.
Local Law Enforcement needs Crime Lab support:

- Validation of Rapid DNA unit
- Training – sample collection and processing
- Review of data
- Managing local or state database
- Processing evidentiary samples for trial
Implementation – Current Early Access Customers

Criminal Justice\Law Enforcement

- FBI
- Palm Bay Police Department, Palm Bay, FL
- DNA Si: Laboratories, Burlington, NC
- Arizona Department of Public Safety (2 units)
- Key Forensic Sciences, UK
- KLPD – Netherlands
- University of Copenhagen
- Dubai Police Department

US Government

- Department of Defense – multiple Units
- DHS – multiple units
- Other classified installations
Rapid DNA is an *inevitable* part of the future of forensic DNA analysis and tactical law enforcement.

Sample in, DNA fingerprint out – in less than 90 minutes.

Rapid DNA is expanding the role of DNA into high volume crimes.

Expanded use of DNA will help solve more crimes & more types of crimes, quicker.

RapidHIT™, the leading Rapid DNA technology, is now available now as an Investigative Lead Tool.
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You’re invited!  
Please come visit us and see the RapidHIT™ in action.