

Rapid DNA Identification of Human Remains: A New Path Forward for the Medico-legal Community

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ABSTRACT

- There are currently 40,000 unresolved human remain cases within the United States related to accidents, murders, and natural causes. Many have family DNA reference samples available to compare against
- Majority of medical examiners and coroners can't process DNA from human remains as they do not have any in-house DNA testing capabilities or budgets for outsourcing
- Rapid DNA, a portable printer sized instrument, generates five DNA profile in 90 minutes, offering an affordable solution to DNA testing needs
- Massachusetts Office of the Chief Medical Examiner (MA OCME) was the first OCME in the world to purchase the Rapid DNA instrument for use in daily operations
- Rapid DNA is portable and ruggedized for field use, so OCME's can bring Rapid DNA with them to respond to critical incidents
- MA OCME is pursuing AABB accreditation
- Multiple mass fatality field exercises have shown Rapid DNA supports field morgue and family assistance center/victim identification center DNA collections and processing
- Kinship matches can be made in 2 hours, saving time and reducing cost of morgue and FAC/VIC operations

RAPID DNA

- Provides family relationship (kinship) verification which is portable, ruggedized, and automated
- Integrates five forensic lab processes with disposable microfluidic technology
- Automation allows operators to process samples and receive final results in real time
- Reduces multi-million dollar laboratory operations to one field device
- Based on microfluidics and traditional short-tandem repeat processes. 24 to 27 DNA locations includes FBI 20



USE OF RAPID DNA IN MASS FATALITIES

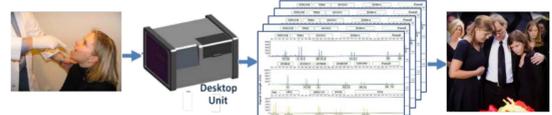
Rapid DNA Expedites Morgue Operations and Reduces Cost:

- Samples can be tested faster than it takes to complete the examination of the human remains in the morgue
- Know in 90 minutes if there is an acceptable DNA profile
- Speeding identification reduces cost of body storage and re-collections



Rapid DNA Can Expedite Family Reunifications:

- Samples tested faster than eight page VIP interview.
- Supports tests of either family buccal swabs (kinship) or direct identity references (hairbrush, toothbrush, etc.)
- Direct feedback on sufficiency of DNA for identification.
- Families receive immediate action.



EXERCISE #1: OPERATION READY

Boston, Massachusetts October 2, 2015

- Purpose: Deployment of Rapid DNA instruments to FAC
- Findings: Rapid DNA instruments are able to be transported and swiftly setup in the FAC of a mass fatality incident



EXERCISE #2: BOSTON LOGAN FAC

Boston, Massachusetts March 2, 2016

- Purpose: Determine if Rapid DNA can be successfully implemented into a Family Assistance Center (FAC) in order to more efficiently reunify family members to the deceased victims of a mass fatality incident
- Findings: Forensic Nurses collected samples from 20 "family members" and were successfully processed by ANDE and IntegenX Rapid DNA instruments in the FAC. This showed that DNA samples from family members can be processed faster than a traditional Victim Identification Program (VIP) form can be filled out to reunify family members and victims



EXERCISE #3: VIGILANT GUARD

Jericho, Vermont July 29-30, 2016

- Purpose: Determine if Rapid DNA instruments can be transported into a disaster site to process tissue from human remains
- Findings: Rapid DNA is able to identify mass casualty victims even prior to body recovery, especially if human remains are contaminated and cannot be immediately transferred to a morgue. These DNA profiles can be matched against family member or reference DNA samples collected in the FAC, permitting rapid and high-confidence victim identification and reunification of families



EXERCISES #4 AND #5: OPERATION MEGA DEATH / HEARTLAND AND FEMORS DRILL

Dayton, Ohio and Miami, Florida May 2017

- Purpose: Assess if Rapid DNA operations can be conducted simultaneously in the FAC and temporary morgue to produce identifications
- Findings: Buccal swabs from the FAC and tissue samples from the morgue were able to be processed and profiles generated from Rapid DNA instruments at two locations. In Miami, three identifications were made from the simulated human remains. Rapid DNA demonstrated that DNA results can be obtained prior to the deceased being sent to storage and before family members leave the FAC



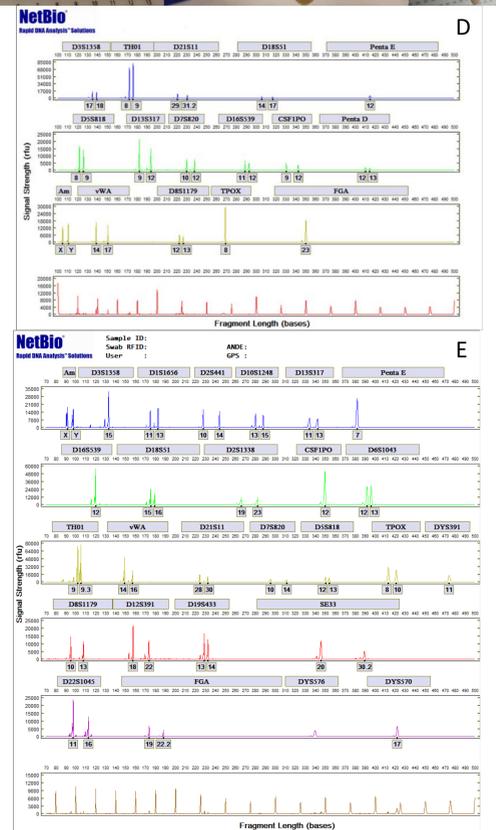
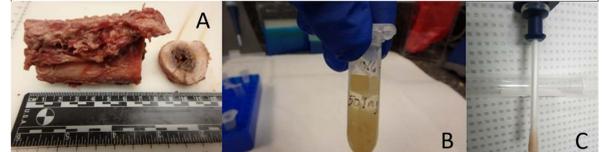
MA OCME RAPID DNA LABORATORY

- MA OCME purchased a Rapid DNA system in June 2015
- Rapid DNA Technology is used to:
 - Generate STR profiles from tissue obtained from decedent
 - Generate STR profiles from buccal swabs donated by relatives of missing persons
 - Direct reference samples with Rapid DNA swabs from personal items (e.g. toothbrush)
- Useful as an identification method in a mass fatality



BONE PROCESSING

- Profiles can be obtained from bone in varying stages of decomposition
- Involves a simple pre-processing step
- Results are available within 24 hours
- Complete profiles obtained



Figures A-E: A) Human bone cut for processing, B) Processed bone, C) Swab with processed bone, D) Electropherogram of a bone sample generated with the PowerPlex® kit, E) Electropherogram of a bone sample generated with the FlexPlex™ kit

AABB ACCREDITATION

- AABB (formerly the American Association of Blood Banks) examines laboratories for compliance with internationally accepted quality management standards
- The MA OCME applied to the AABB Standards Committee for variances for Rapid DNA in January 2017
- Variances were granted for Rapid DNA testing in April 2017
- Rapid DNA (Closed Systems) will be included in AABB's 13th Edition Standards for Relationship Testing
- The following documents were generated:
 - Self-Assessment Tool
 - Master Document List
 - Relationship Testing Manual
 - Paternity Reports (Inclusion and Exclusion)
 - Biological Relationship Report (Sibling)
 - ANDE FlexPlex and OSIRIS Validation
 - Kin Calc Validation

CONCLUSIONS / LOOKING FORWARD

- On-site AABB assessment scheduled for August 2017
- Continue to test and validate the instrument through field studies
- Participate in full scale fatality exercises to determine how to improve the integration of Rapid DNA testing