WHO Conference on Health Aspects of Tsunami Disaster in Asia

Phuket, Thailand
4–6 May 2005
WHY DNA?

Theresa Caragine, Ph.D.
tcaragine@nyc.rr.com
Modalities of Identification

- Personal recognition (photo)
- Fingerprints
- Dental X-Rays
- Unique radiology
- Identifying characteristics (tattoo, scar)
- Personal effects (jewelry, medical devices)
  - not recommended
- DNA

Comparisons Unavailable
Interpol Recommendation

• Identify each person with two modalities if possible

• Radiology and fingerprint records and/or identifying marks on victim may not be available.
Challenging Remains: DNA Most Reliable Method For Identification

• Severely damaged remains
• Fragmentation
• Commingling
Bone Samples in Increasingly Worse States of Preservation

1.

2.

3.

4.
Fragmentation
Incorrect Associations?
Commingling of Remains
The Case of the “Thoracic Mandible”

Demonstration of the Need for DNA Confirmation for Identification
Remains in Triage
Medical Examiner Worksheet
Personal Property

- Wallet in body bag but not in clothing.
- Driver’s license, credit card and work ID for “John Doe”.
- Not enough to ID, but can be used to guide investigation.
Hands: Fingerprints & Ring
Hands: Fingerprints & Ring
Fingerprints from Police Record Match John Doe Remains
“John Doe’s” Wedding Date and jewelry description matches ring.
Dental X-rays for “John Doe” match mandible recovered from remains.

Post mortem dental

Ante mortem dental
Radiology discovers another mandible in thoracic cavity
Dental matches a different victim than “John Doe”
DNA Profile obtained with Kinship supports 1\textsuperscript{st} mandible.

1\textsuperscript{st} mandible
Father & sib of ‘John Doe’
BUT other personal effects linked to 2nd mandible.

1st mandible
Father & sib of ‘John Doe’

2nd mandible
Personal effect of 2nd ‘John Doe’ & remains
Conclusion

DNA MATCH (but same body part)

WTC Integrated for Victim Data

Property Jewelry Fingerprints Dental Anthro

Medico-Legal Investigations
Identification of WTC victims

1,583 victim’s identified
54% by DNA alone
11,583 pieces identified
DNA Matching Process Overview

- Database Personal Effects and Remains
- Match
- Administrative Review
- DNA Profile Confirmation
- No Conflicts
- Reconciliation Center

Conflict Resolution
Step 1: DNA Match

Database
DATA

- Personal Effects
- Kinship
Step 2: Confirmation of Sources of Information

- Kinship Donor Information
- Victim Confirmation
- Administrative Review
- Family Structure
- Lab Numbers
- Collection Confirmation @ NYPD or OCME
Step 3: DNA Profile Confirmation

- Two PE Matches
- One PE Match
- One PE + Kin
- Kinship Match

- Personal Effect Re-Analysis
- Kinship Analysis
# Sources of DNA Reference Samples

## Good Sources
- Toothbrushes
- Electric Razors
- Hairbrushes
- Used Underwear
- Dried bloodstains
- Other clinical or blood specimen samples
- Sperm bank samples
- Dried umbilical cord

## Fair Sources
- Parafilm embedded specimens
- Cervical smears
- Cigarette butts, pipes
- Mouth piece, mouth guard
- Caps, helmets
- Ear plugs
- Inner clothing
- Pens with teeth marks
- Eyeglasses
- Combs
- Deodorants
- Lipsticks, cosmetics
- Used cups, drinking glasses
Poor Sources of DNA

- Jewelry
- Outer clothing
- Shoes
- Towels

- Hairbands
- Baby hair
- Dentures
- Hair rollers
- Scissors
Remains Samples: Bone

- Humeral or femoral shaft
- Any long bone
- Entire rib
- Foot or hand bone
- Any portion of compact bone left
Teeth

- If teeth are easily removed, submit teeth
- If not, keep teeth intact in the bone
- Other examinations must be completed before DNA testing
Challenging Samples

- Repeated efforts to produce profiles from challenging samples.
- In house optimization of protocols
• Identify the remains
• PCR DNA analysis in a BCL2 laboratory

• Preserve samples for PCR DNA analysis
• Safely return remains to families
Sanitization by Irradiation with an Electron Beam

Electrons disrupt the DNA chain either destroying or preventing reproduction of the organism. Still can detect spores by PCR or antigen assays.

Forensic DNA preserved
Electron Beam Sterilization Technology

How It Works

Generates electrons
Accelerates electrons
Spreads E-Beam
Treats product
Electrons penetrate package

Product Container
Magnetic Scanning System
Input RF Power
Accelerating Waveguide
Injecto
Process Conveyor

2002 The Titan Corporation
E-beam: Penetrating Ionizing Radiation

- Penetrating: electrons pass through material, not just a surface treatment
- Ionizing: disrupts molecules by stripping off electrons, breaking bonds, etc.
- Radiation: energy from accelerated electrons

Practical Operational Issues
- Throughput is based on the dose
- Kills all biological pathogens
- Greatly reduces effects of chemical agents
Efficacy of E-beam Radiation for Biological and Chemical Agents
Irradiated Bloodstains Produced Sufficient Loci for Comparison

Radiation Dose (kGy) vs Allelic Determinations (%)
Continued Contact with Families

- Resolve Discrepancies
- Explain difficulties and delays
- Maintain motivation
Ground Zero: One Year Anniversary

Robert Shaler, Ph.D.

Reconstruction

Howard Baum, Ph.D.
Mechthild Prinz, Ph.D.
Elaine Mar
Erik Biescke
Zoran Budijimila, M.D., Ph.D.
Sheila Estacio
Lydia DeCastro