Forensic DNA Technology: A Powerful Tool for Judicial Reform

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Outline of the Presentation:

• Introduction
• DNA research for forensics
  – Polymorphisms and databases
  – Optimization and fast-tracking reactions
  – New developments
• Conclusion
  – How can one say that the use of DNA for forensics has indeed reformed the Philippine justice system?
Forensics is the application of a broad spectrum of sciences to answer questions of interest to the legal system. This may be in relation to a crime or to a civil action.

American Academy of Forensic Sciences

FORENSIC APPLICATIONS

- Investigations: Civil/criminal
- Disputed parentage cases
- Mass disasters

IDENTIFICATION!
FORENSIC INVESTIGATION

- Crime scene investigation
- Collection, preservation of physical evidence
- Laboratory analysis & interpretation
- Collection of testimonial evidence
- Appreciation of evidence in Court

From Calacal G, 2007

Sources of DNA
- Hair
- Teeth
- Blood
- Skin Cells
- Semen
- Bone

From DNAProject, South Africa
How is DNA typing done?

1. Briefing and signing of documents
2. Sample collection or submission of sample
3. DNA extraction
4. Polymerase Chain Reaction (PCR)
5. Automated DNA fragment analysis
6. Statistical analysis if needed and report writing
7. Release of Report

From DNAProject, South Africa
1- DNA markers for Profiling

- Search for highly polymorphic markers in a given population;
- Suitability for multiplex reactions to enhance genetic information/amount of biological sample; and
- Establishment of reference databases for the evaluation of statistical weight of evidence
Evaluating DNA tests of motherless cases using a Philippine genetic database


Announcement of population data
Allele frequencies of 19 STR loci in a Philippine population generated using AmpFlSTR multiplex and ALF singleplex systems
Maria Corazon A. De Ungria, Rhonda K. Roby, Kristina A. Tabbada, Salekha No-Coticon, Michelle Music M. Tan, Karen N. Hernandez

Expanding the Philippine Autosomal Short Tandem Repeat Population Database for DNA-based Paternity Testing


Salvador JM, Tabbada KA, De Ungria MC.
DNA Analysis Laboratory, Natural Sciences Research Institute, University of the Philippines, Diliman, Quezon City 1101, Philippines.

Asian online Y-STR Haplotype Reference Database

The Y-chromosome landscape of the Philippines: extensive heterogeneity and varying genetic affinities of Negrito and non-Negrito groups

Frederick Delfin, Jazelyn M. Salvador, Gayvelling C Calacal, Henry B Perdigon, Kristina A Tabbada, Lilian P Villamo, Saturnina C Halos, Ellen Gunnarsdottir, Sean Myles, David A Hughes, Shuhua Xu, Li Jin, Oscar Lao, Manfred Kayser, Matthew E Hurles, Mark Stoneking and Maria Corazon A De Ungria.
2- Chemical reactions for optimization

• Handling ‘difficult’ samples, e.g. archived or highly challenged;

• Reduction in time for DNA analysis using more robust reaction buffers and direct amplification strategies

Identification of exhumed remains of fire tragedy victims using conventional methods and autosomal/Y-chromosomal short tandem repeat DNA profiling.

Calacal GC, Delfin FC, Tan MM, Roewer L, Magtanong DL, Lara MC, Fortun R, De Ungria MC.
PowerPlex® 21 Validation: Sensitivity (Direct Amplification)

- Blood on FTA card
- Buccal swab on Bode (+ PunchSoln)
- Cotton swab (+ SwabSoln)

Salvador et al 2012 AFSN
3- CSI in real-time and automating laboratory analysis

• Handheld devices and portable systems for fast DNA profiling ‘real time’ at the crime scene;
• Use of robotics for generating a DNA profile and expert systems for analysis; and
• Criminal Database access via cloud computing
DNA as a tool for Judicial Reform

Section 8. Reliability of DNA Testing Methodology.— Whether the DNA testing methodology is reliable.

Section 9. Evaluation of DNA Testing Results.— In evaluating the results of DNA testing, the court shall consider the following:

(c) DNA results that exclude the putative parent from paternity shall be conclusive proof of non-paternity. If the value of the Probability of Paternity is less than 99.9%, the results of the DNA testing shall be considered as corroborative evidence. If the value of the Probability of Paternity is 99.9% or higher, there shall be a disputable presumption of paternity.

Section 10. Post-conviction DNA Testing. Remedy if the Results are Favorable to the Convict.— The convict or the prosecution may file a petition for a writ of habeas corpus in the court of origin if the
UP-NSRI DNA Analysis Lab:

- **Senior Scientists:**
  - Gayvelline Calacal
  - Frederick Delfin
  - Jazelyn Salvador

- **Junior Researchers:**
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  - Paul Ryan Sales

- **Senior REPS:**
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  - Minerva Sagum

- **Consultants:**
  - Dr Saturnina Halos
  - Atty Jose Jose

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