The Application of Forensic DNA Analysis in Sexual Assault Cases in Taiwan

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The development of forensic DNA in Taiwan

• The forensic DNA laboratory of CIB was set up in 1992.
• Completed the first DNA analysis in sexual assault case in 1993.
• Almost 2000 rape cases every year.
• Our first rape evidence collection kit was developed until Sexual Assault Crime Prevention Act was passed in 1997.
• Fetus tissue collection kit for misfortune pregnant victim and urea & blood sample collection kit for drug analysis for sexual assault case was set in 2004 and 2011.
The rape evidence collection kit was developed until Sexual Assault Crime Prevention Act was passed in 1997.
What to collect

• Rape kits include the following items:
  • Instructions
  • Bags and sheets for evidence collection
  • Swabs for collecting fluids from the oral cavity, vagina, anus, and other touch area.
  • Comb used to collect hair and fiber from the victim’s body
  • Self-sealing envelopes for preserving the victim’s clothes, head hair, pubic hair, and trace evidence.
  • Nail pick for scraping debris from beneath the nails
  • White sheets to catch physical evidence stripped from the body
  • Documentation forms
  • Labels
Fetus tissue collection kit

Genetic Health Act
Article 9
Induced abortion may be conducted for a pregnant woman, subject to her own accord, if she has been diagnosed or proven to meet any one of the following: …
5. Pregnancy as a result of being raped, lured into sex intercourse.....
Urea & Blood Collection kit for Drug Analysis 2004
The analysis strategy for sexual assault evidences

- Acid Phosphatase test for identification of semen stain and then followed by differential extraction method to obtain separate male semen fractions or not.
- Quantifiler™ Trio DNA quantification kit (Quantifiler Trio) to evaluate DNA quality, quantity and male/female ratio of DNA extraction results.
- AmpFlSTR™ Identifiler™ Plus PCR Amplification kit is applied for general evidences STR typing.
- For paternity testing, GlobalFiler™ PCR Amplification kit is applied because of its superior discrimination power.
- If the male DNA is less than 10% of female DNA, Y-STR typing is the better choice.
- Y-STRs is now widely used in our laboratories and particularly in sexual assaults cases.
Serology Test for Semen

Acid Phosphatase Test

Immune-Chromatographic Test for prostate specific antigen, PSA or P30
Semem Conform test

Find sperm cell by Microscope method
or
Immune-Chromatographic Test for semenogelin
Y STR Typing or Not

- Y DNA concentration and male/female DNA ratio was evaluated
- The amount of trace male DNA can be more accurately estimated by using Quantifiler Trio than Quantifiler Y Human Male DNA quantification kit (Quantifiler Y).
- The Y quantification is more concordance with Yfiler™ Plus kit or PPY23 typing results.
Y DNA Evaluation

One blood stain found on the seat of suspect’s car was evaluated by using the Quantifiler Trio DNA Quantification Kit with the Applied Biosystems 7500 Real-Time PCR System.

T.LA=2.56, T.SA=3.65, T.Y=0.08 (ng/ul), S/L=1.43 no degradation
The ratio of male to female is 1:30
The DNA-STR Result of the Blood Stain

The ratio of male to female is 1:30.
The typing result match with the victim.

AmpFLSTR Identifier Plus PCR Amplification Kit
Equipment: GeneAmp™ 9700, 3500xL Genetic Analyzer
The Y-STR Result of the Blood Stain

DNA template: $2.56 \times 10 = 25.6\text{ng}(F)$, $Y = 0.08 \times 10 = 0.8\text{ng}$

The Y-STR typing result match with the suspect.

Yfiler Plus PCR Amplification Kit
Equipment: GeneAmp 9700, 3500xL Genetic Analyzer
The Y-STR Result of VS

T.LA=6.55, T.SA=4.94, T.Y=0.0023 (ng/ul), S/L=0.75
DNA template : 6.55*17.5=114.63ng(F), Y=0.0023*17.5= 0.04ng
PowerPlex® Y23 System
Equipment: GeneAmp 9700, 3500xL Genetic Analyzer
Paternity Test

Compare the DNA-STR result of Victim (mother), Suspects (father), and the Fetus, CPI = 5.30 × 10^{10}

DNA template: 0.5ng
GlobalFiler PCR Amplification Kit
Equipment: GeneAmp 9700, 3500xL Genetic Analyzer
The DNA Sampling Act
(since 1999, revised in 2011)

Article 5. The accused or suspects committing any of the following offenses of Criminal Code shall be subject to the mandatory DNA sampling:

- Offenses Against Public Safety (serious)
- Sexual Offenses
- Offenses of homicide
- Offenses of causing serious injury
- Offenses of Abrupt Taking, Robbery and Piracy
- Offenses of Extortion and Kidnapping for Ransom

The accused or suspects who are convicted of any of the following offenses and recommit any offenses provided in this paragraph shall be subject to mandatory DNA sampling: (revised in 2011)

- Offenses Against Public Safety....
- Offenses Against Abandonment
- Offenses of Larceny...
- Offenses of Abrupt Taking, Robbery and Piracy (general)
- Offenses of Against the Firearms, Ammunition and Knives Control Act (Article 7, 8, 12, 13)
- Offenses of Against the Narcotics Control Act (Article 4, 8, 10, 12)
The Matching policy of evidence and DNA data base

If evidence match the data base, that means solving the crime.

If new data base sample match the old evidence, that means solving the cold case.

CIB and 5 City Police DNA Lab

By the DNA Sampling Act

DNA Typing result

Forensic Evidence

If evidence match each other, that means series of crimes.
The DNA Data Base 2019.June

Total DNA Samples: 146,078
Special Case Report

In September 2016, a teenager girl finished her tuition class, at around 8 p.m., the girl was walking home and a man approached her. After the man get close to her, he sprayed her with chilli water, grabbed her into the grass on the side of the road, choked her neck, took off her pants, touched and licked the victim's sexual organs. The man ran away and the victim was taken home by a passer-by, then accompanied by her family to the police and taken to the hospital for evidence collection.
The underwear Evidence

Trace DNA was sampling
T.LA=0.0973,
T.SA=0.0819,
T.Y=0.0057(ng/ul)

ACP: -
P30: -
T.LA=1.8933
T.SA=2.0495,
T.Y= UD
DNA template : 0.0973*17.5=1.70ng(F),
Y=0.0057*17.5= 0.1ng
PowerPlex® Y23 System
Equipment: GeneAmp 9700, 3500xL Genetic Analyzer
Cold Case

• The suspect was caught and his Y-STR typing result was match with the Y-STR DNA result of the underwear.
• The suspect’s DNA sample was analysis by IDP then compared with the whole forensic DNA database.
• The suspect’s DNA-STR typing match with two old cases from 18 years ago.
• The victims of these two cases were teenager girls and almost the same criminal method that happened in 1998 and 1999.
The old DNA-STR result in file

Sperm cell fraction of VS of victim, 1998

Sperm cell fraction of victim underwear, 1999

Profiler™ kit: D3S1358, vWA, FGA, TH01, TPOX, CSF1PO, D5S818, D13S317, D7S820 and Amelogenin.
The new DNA-STR typing result

After 17 years of frozen storage

AmpFLSTR Identifier Plus PCR Amplification Kit
Equipment: GeneAmp 9700, 3500xL Genetic Analyzer

Sperm fraction of victim underwear, 1999
The sexual assault offenders got 7 years and 10 month sentence in April 2018. Two cold cases that happened in 18 years ago will continue to be prosecuted by other trial.
Team work
Let criminal can not be escaped.
Let our society be more safe.
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