Chapter 9

Forensic Analysis

DNA Fingerprinting

- Also call as DNA profiling/ DNA testing, DNA typing, or genetic fingerprinting
- To assist in the identification of individuals by their respective DNA profiles
- Encrypted sets of numbers that reflect a person's DNA makeup, which can also be used as the person's identifier
- It is used in, for example parental testing and rape investigation

DNA profiling

- Uses repetitive ("repeat") sequences that are highly variable,called VNTR
- VNTRs loci are very similar between closely related humans, but so variable that unrelated individuals are extremely unlikely to have the same VNTRs

Preparation of DNA fingerprinting

1. Specimen collection

- Sample of an individual's DNA called reference sample
- Using buccal swab to reduces the possibility of contamination
- Other sample :blood, saliva, semen, or other appropriate fluid or tissue from personal items (e.g. toothbrush, razor, etc.) or from stored samples

On the trail of killer

- Crime scenes : small or big diameter (air plane crash)
- Crime Scene protocol : police (1st to arrive) and forensic assistance
- Safety first
- Body count
- Preserving the evidence
- Security measures

Finding a definite match

- Fingerprintes : no chance of 2 persons of having identical fingerprints not even identical twins
- Bullet striations: Matching the scratches on bullet with imperfections in the barrel of a gun
- Footprints: Fine details of the tread on a person's shoes

What are kind of substance are tested?

- Hair : microscopic evidence, animal or human?
- Fibers : Natural (wool/ cotton) or synthetic (rayon, nylon etc)
- Drugs: Heroine, coccaine, barbiturates, painkiller
- Explosive and residues: gunshot residues,burn marks at explosive sites

1. Sample collection

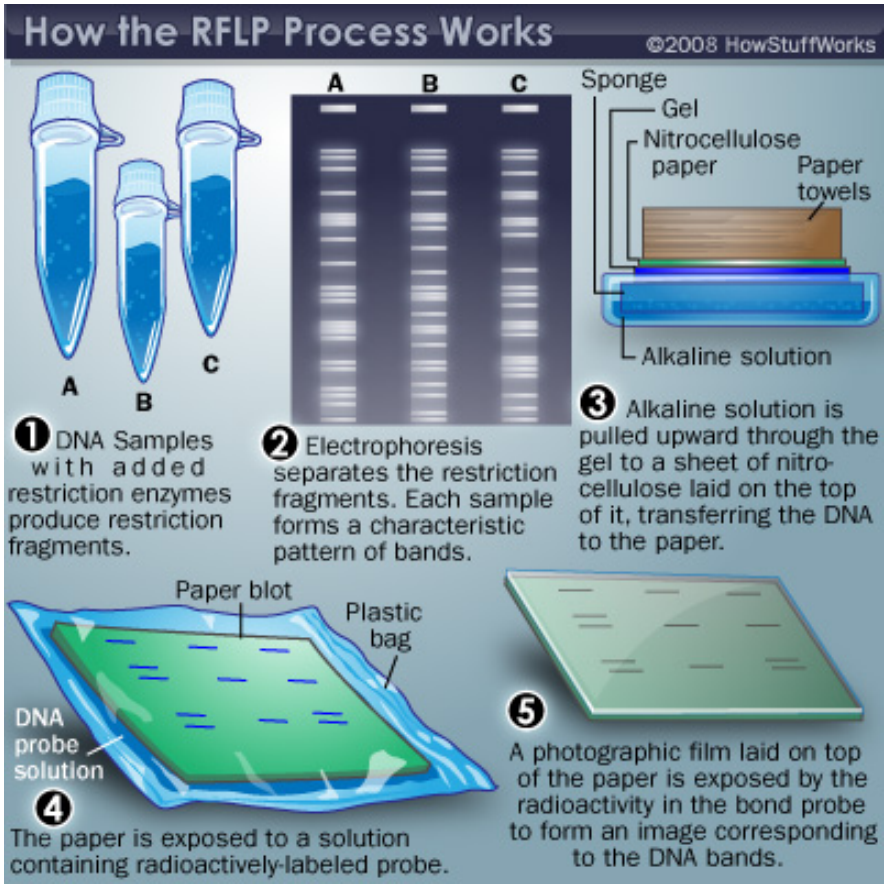
- Samples obtained from blood relatives (biological relative) can provide an indication of an individual's profile, as could human remains which had been previously profiled.
- A reference sample is then analyzed to create the individual's DNA profile using one of a number of techniques, discussed below.
- The DNA profile is then compared against another sample to determine whether there is a genetic match

2. DNA Extraction

- Lab technician
- Chemically or mechanically
- Steps must follow to transform the unique signature DNA
- Hamilton Robotic: inclusive method until analysis

Tools

- RFLP (Restriction Fragment Length polymorphism)
- PCR
- STR Analysis
- AmpFLP



DNA Database

- Existence around the world
- Some are private, but most of the largest databases are government controlled
- CODIS in USA, holding over 5 million records as of 2007.
- In UK, NDNAD (National DNA Database)

Applications

- 1. Murder/ Mass tragedy by natural disaster
  - The Narborough Village Murders
  - The Forest Hill Rapist
  - World Trade Centre
  - South Asian Tsunami

Family Relationship and DNA Profiles

- Paternity Testing
- Child support and custody
- Artificial reproduction : sperm mix up in fertility clinic and surrogacy issue
- 2 technique involved
  - Mitochondrial DNA Analysis
  - Y-Chromosome Analysis

Mitochondrial DNA (mtDNA)

- For highly degraded samples
- In these situations, (mtDNA) is sometimes typed due to there being many copies of mtDNA in a cell, while there may only be 1-2 copies of the nuclear DNA
- Case study: Anna Anderson as Anastasia Romanov

Y-Chromosome Analysis

- Recent innovations have included the creation of primers targeting polymorphic regions on the Y-chromosome, which allows resolution of a mixed DNA sample from a male and female
- Y-chromosomes are paternally inherited, so Y-STR analysis can help in the identification of paternally related males
- Case study: Thomas Jefferson