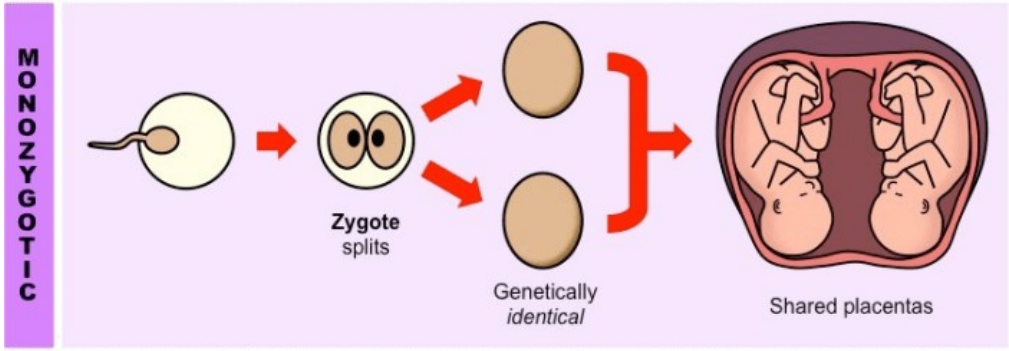
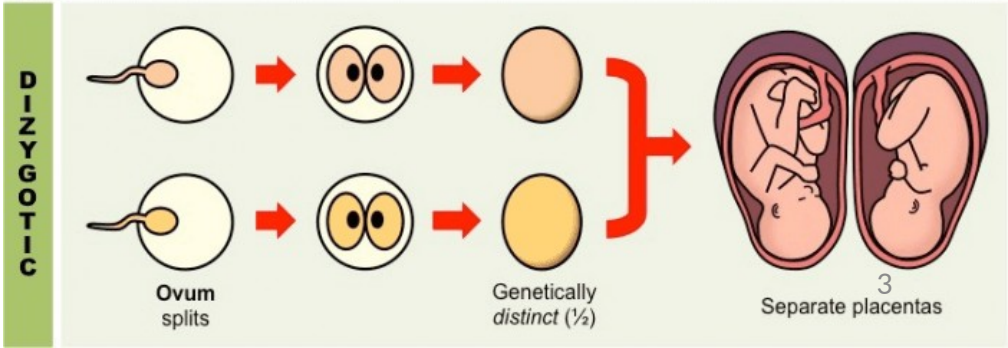
Learning Objectives

- By the end of this session the learners will be able to:
  - Describe structure and uses of DNA
  - Explain gene and junk DNA
  - Enumerate the methods of DNA analysis
  - Describe the Samples Collected from Living Subjects and dead bodies
  - Discuss medicolegal aspects of DNA Fingerprinting

DNA Fingerprinting

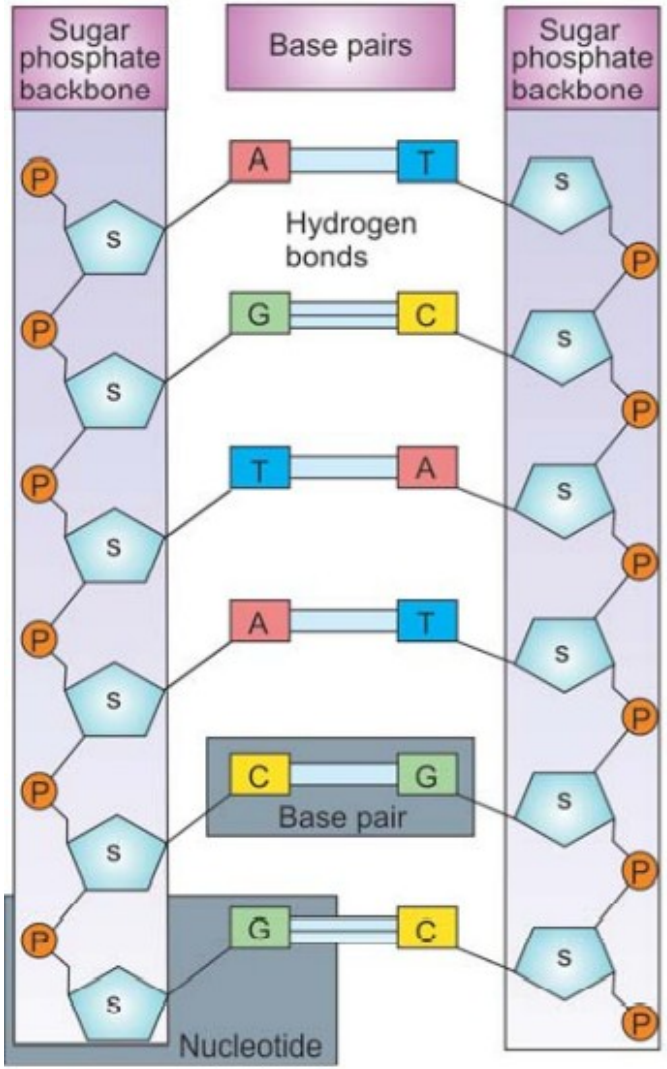
- What is DNA fingerprinting
- Specificity of DNA
- Alec Jeffreys (1984)
- DNA is a sturdy molecule
- Chances of similarity

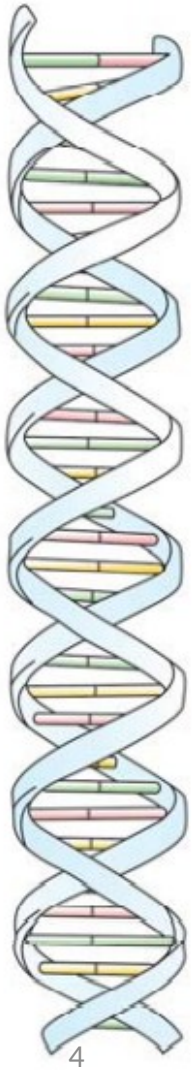




DNA Fingerprinting

- Structure of DNA
- Genes
- Redundant segments





Chimera

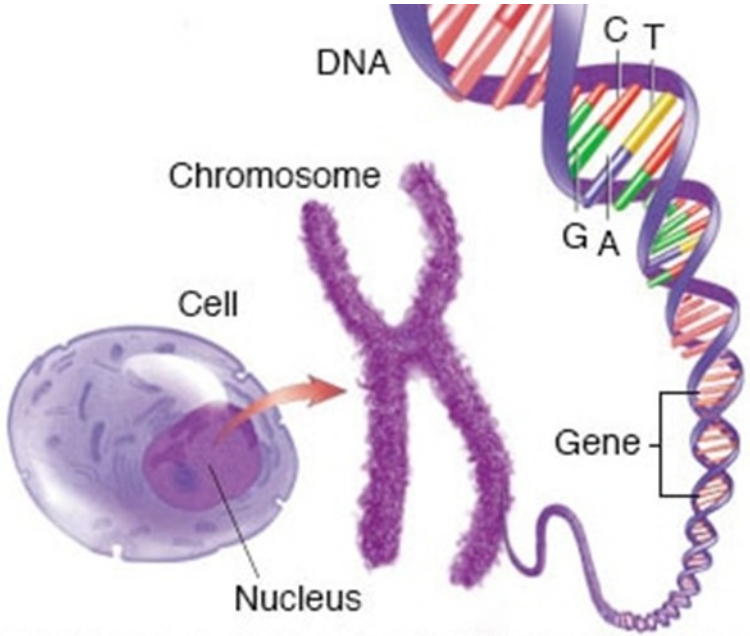
Chimera

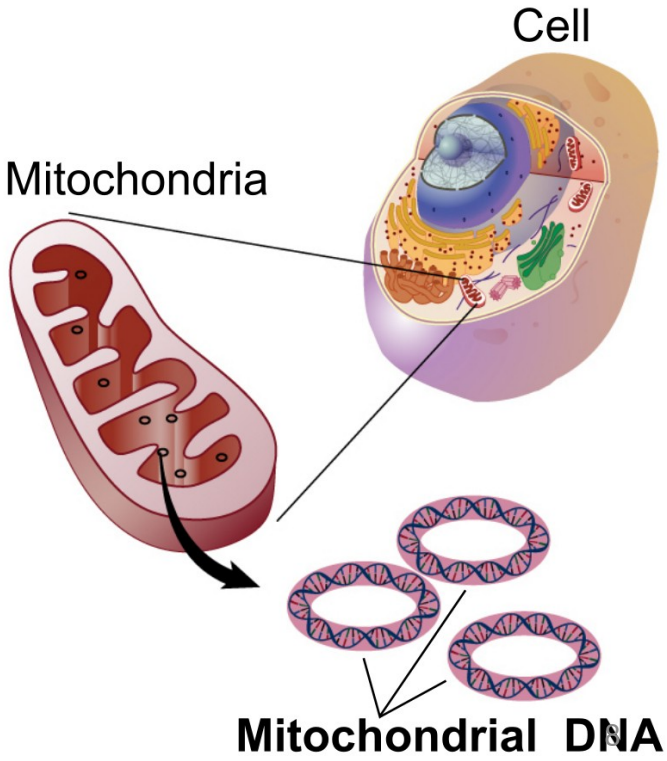
Chimera

- Vanishing twin syndrome
- Fraternal twins
- Transplants
- Microchimerism
- Diagnosis
- Lydia Fairchild 2002
- Taylor Muhl

DNA Fingerprinting

- **Types of DNA**
  - Location
  - Inheritance (mtDNA, Y-DNA)

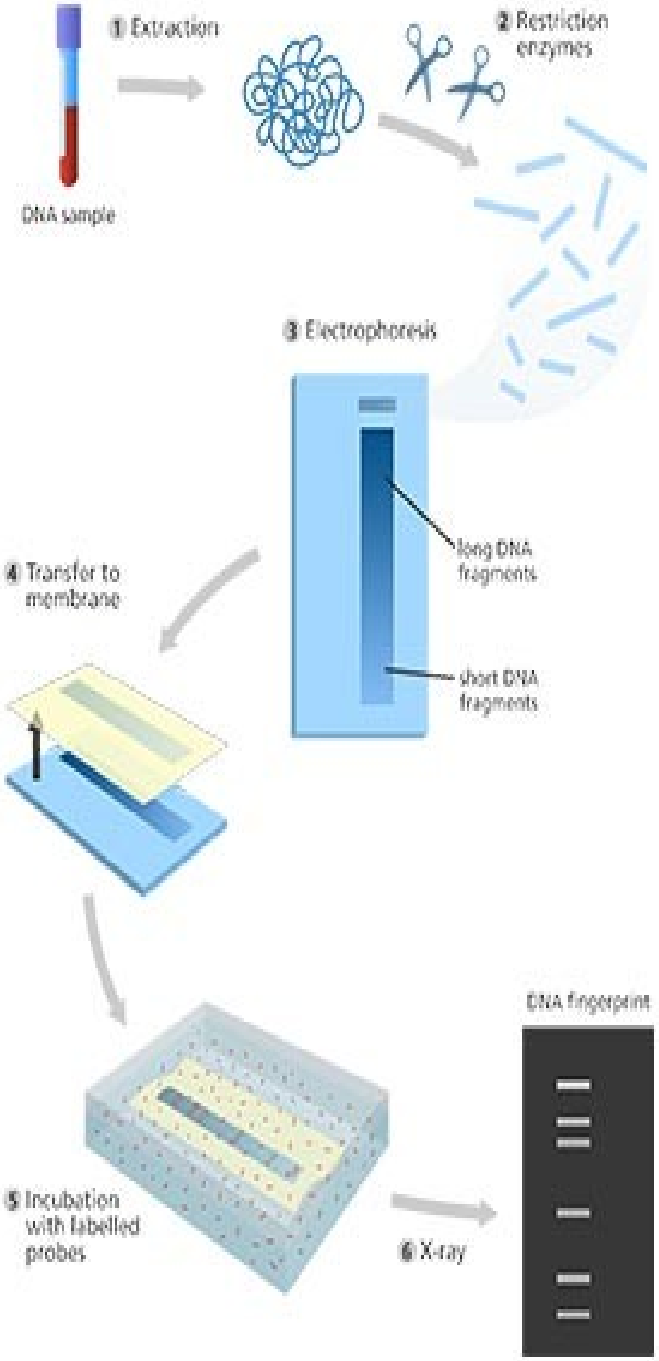


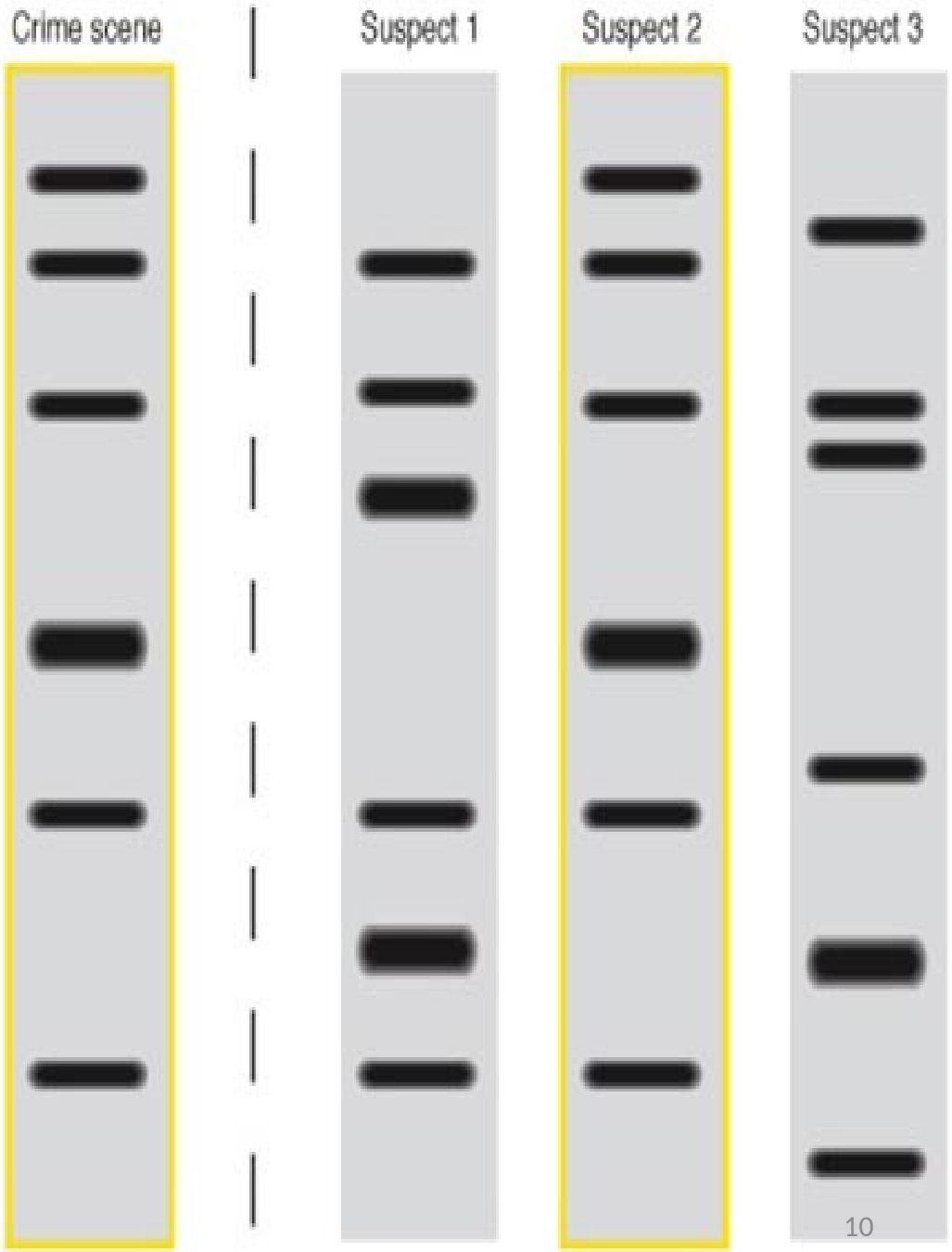


DNA Fingerprinting

- **Methods of DNA analysis**

- **Extraction, Detection and Visualisation of DNA**
  - Cells burst open
  - Proteins precipitation
  - Cleaning
  - Cutting of DNA
  - Fragments
  - Agarose gel or polyacrylamide gel electrophoresis


1 Extraction
DNA sample
2 Restriction enzymes
3 Electrophoresis
long DNA fragments
short DNA fragments
4 Transfer to membrane
5 Incubation with labelled probes
6 X-ray
DNA fingerprint


Crime scene
Suspect 1
Suspect 2
Suspect 3

DNA Fingerprinting

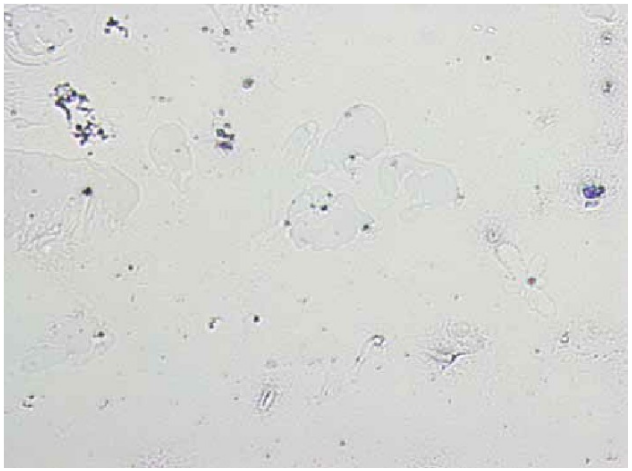
- The essence of DNA profiling in forensic work is comparison between two samples
  - Blood on the weapon
  - Semen from the vagina
  - Hair on the blunt weapon
  - In sexual crimes

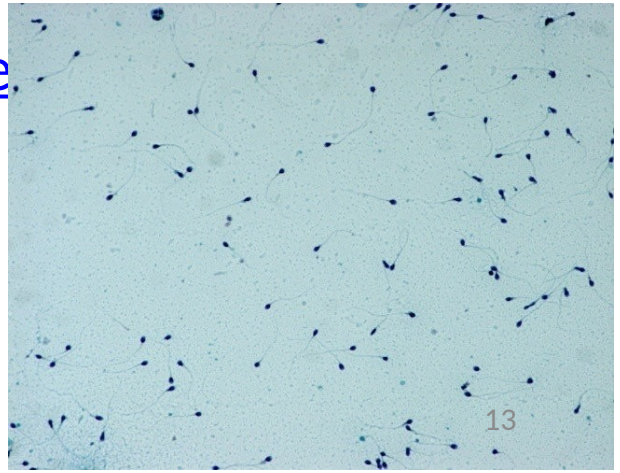
DNA Fingerprinting

- **Advantages of Using DNA for Identification**
  - Ubiquitous
  - DNA is same in all the cells
  - Unique
  - Extraction
    - In charred remains
    - Post-mortem cases
  - Storage
  - Does not combine

DNA Fingerprinting

- **Disadvantages**
  - Requires nucleated cells
  - Trained Human resource
  - Uniovular twins
  - https://www.nytimes.com/2019/03/01/science/paternity.html
  - Accuracy of the results
  - Cost



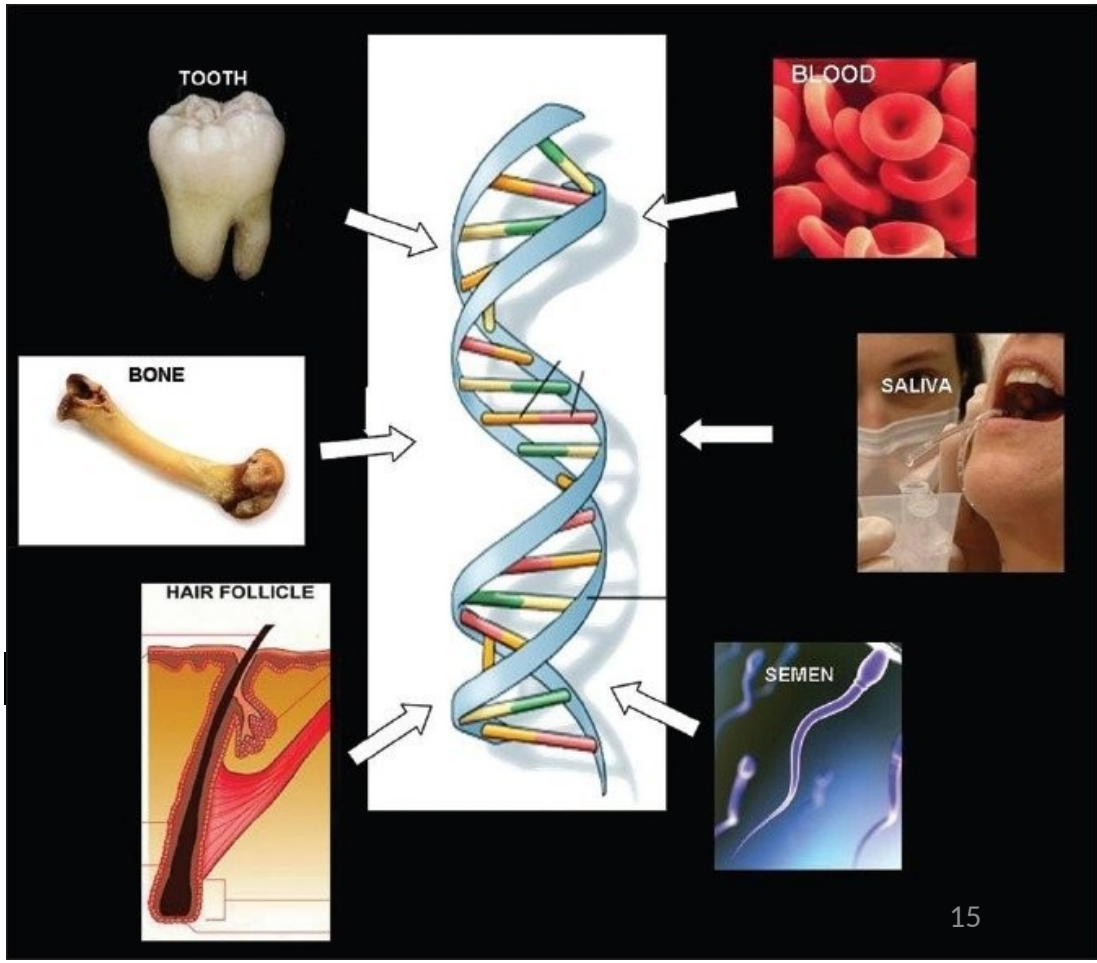


DNA Fingerprinting

- **Specimen Selection and Preservation**
  - **Samples Collected from Living Subjects**
    - Blood
      - 5 ml
      - FTA paper
    - Buccal swabs
    - Plucked hair
  - **Samples Collected from Dead Bodies**
    - Fresh dead bodies
    - Intermediate postmortem intervals
    - Advanced decomposition

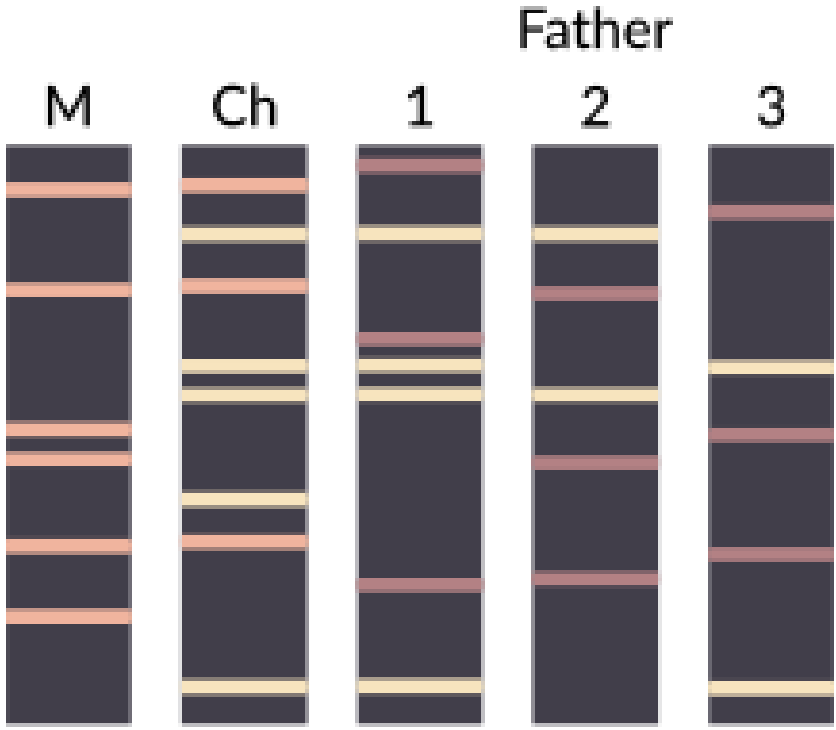
DNA Fingerprinting

- **Samples Encountered in Forensic Practice**
  - Blood
  - Semen
  - Hair
  - Tissue
  - saliva
- **Vaginal swabs**
- **Autopsy tissue samp**



DNA Fingerprinting

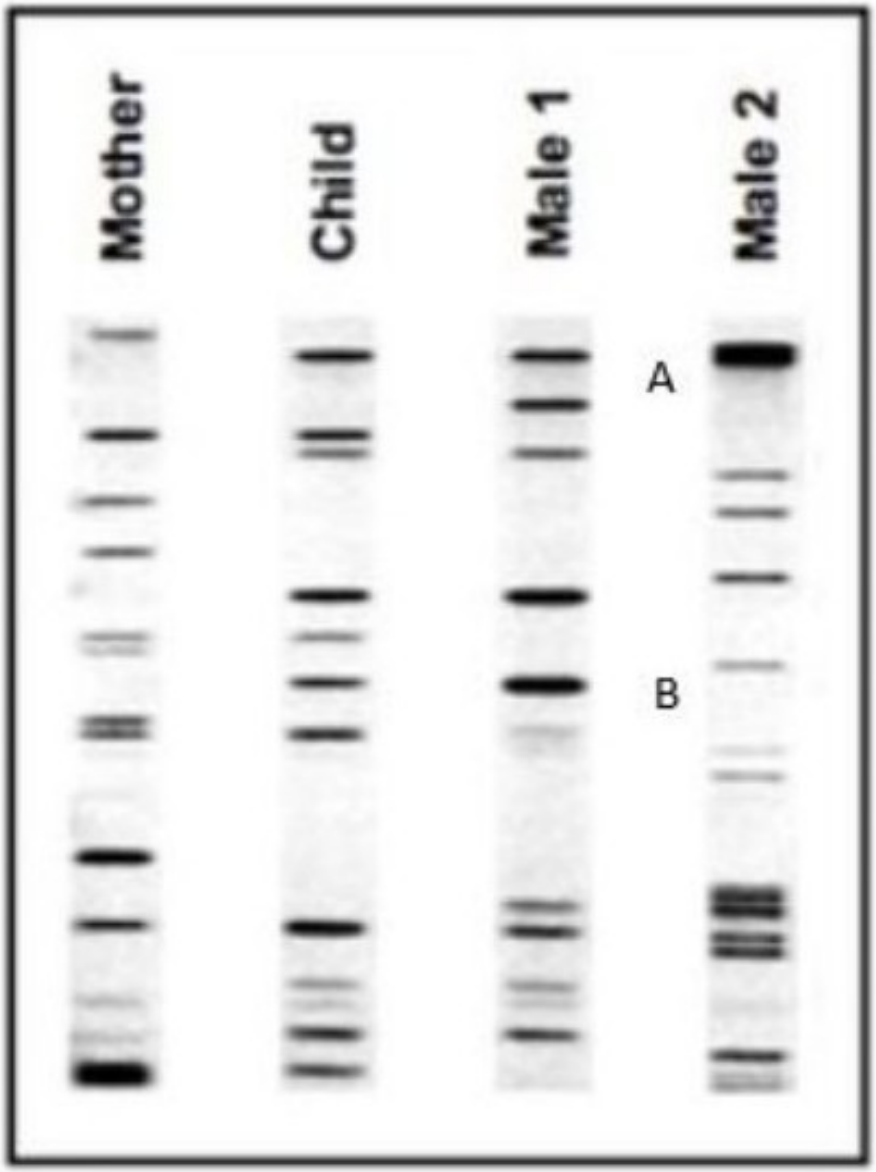
- **Uses of DNA Fingerprinting**
  - Identification
    - Sexual crimes
    - Violent crimes
  - Acquittance of a person
  - Diagnosis of inherited disorders & DNA councillors
  - Paternity/maternity testing
  - Accidents/mass disaster



DNA Fingerprinting

- **Uses of DNA Fingerprinting**
  - To resolve disputes
  - Identification in postmortem practice
  - Twin zygosity
  - Disputed paternity

What type of toll was used to separate the fragments?



References

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- Simpson’s Forensic Medicine Twelfth Edition
- Textbook of Forensic Medicine and Toxicology second edition Nageshkumar G Rao
- Textbook of Forensic Medicine and Toxicology Principles and Practice Fifth Edition Krishan Vij
- Principles of Forensic Medicine and Toxicology Rajesh Bardale
- Review of Forensic Medicine and Toxicology second edition Gautam Biswas

Some techniques are poor in most cases, some good in many cases and some are good in most cases, but none are reliable in every case.

- William R Maples

https://www.nytimes.com/2019/03/01/science/twins-dna-crime-paternity.html

- One night in November 1999, a 26-year-old woman was raped in a parking lot in Grand Rapids, Mich. Police officers managed to get the perpetrator's DNA from a semen sample, but it matched no one in their databases.

- Detectives found no fingerprints at the scene and located no witnesses. The woman, who had been attacked from behind, could not offer a description. It looked like the rapist would never be found.

- Five years later, there was a break in the case. A man serving time for another sexual offense submitted a DNA sample with his parole application. The sample matched DNA from the rape scene.

- There was just one catch: The parolee had an identical twin, and standard DNA tests can’t distinguish between identical twins. Prosecutors had no additional evidence to rule out one or the other. Because they couldn’t press charges against either of the men, the case remains open nearly 20 years later.