

DNA Profiling



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Lecture Plan

- DNA Profiling overview
- Advantages
- Reference or Control Samples
- Limitations
- Evidence Collection
- DNA Databases
- Legal Documents
- Indian Scenario

Biological Clue Materials

Body Fluids & their Stains

Blood

Semen

Vaginal Secretions

Saliva

Urine

Bones, Teeth

Hair, Nails

Body Tissues etc



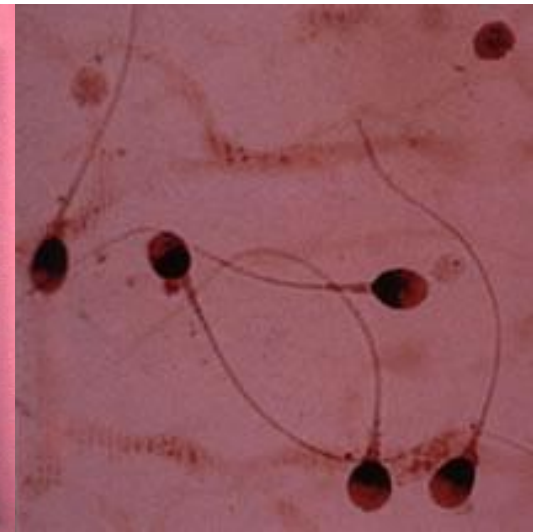
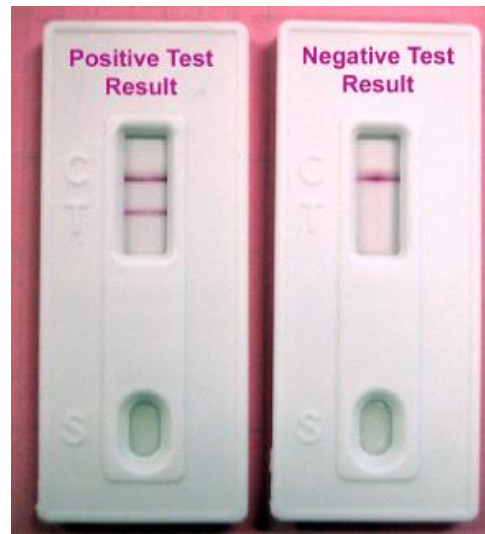
Examination

Detection

Is it Blood/Semen/Saliva?

Species of Origin

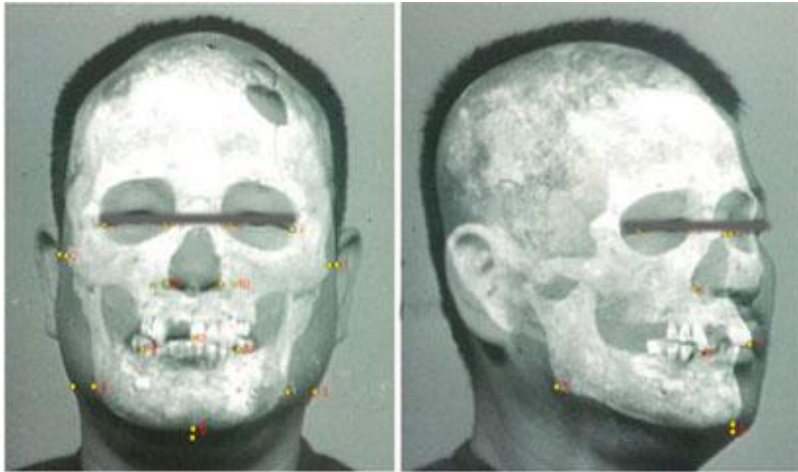
Human or Animal?



Personal Identification

- ◎ Physical & Facial Features
- ◎ Clothing's
- ◎ Anomalies, Tattoo Marks etc
- ◎ **Superimposition**, Facial Reconstruction
- ◎ **Blood Groups, Isozymes/Proteins**
- ◎ Fingerprints
- ◎ DNA Typing

Superimposition & Facial Reconstruction



Blood Group Match

Does it mean individual is the source of evidence ?



Blood Group Distribution

O	A	B	AB
35- 40%	10- 15%	35- 40%	5- 10%

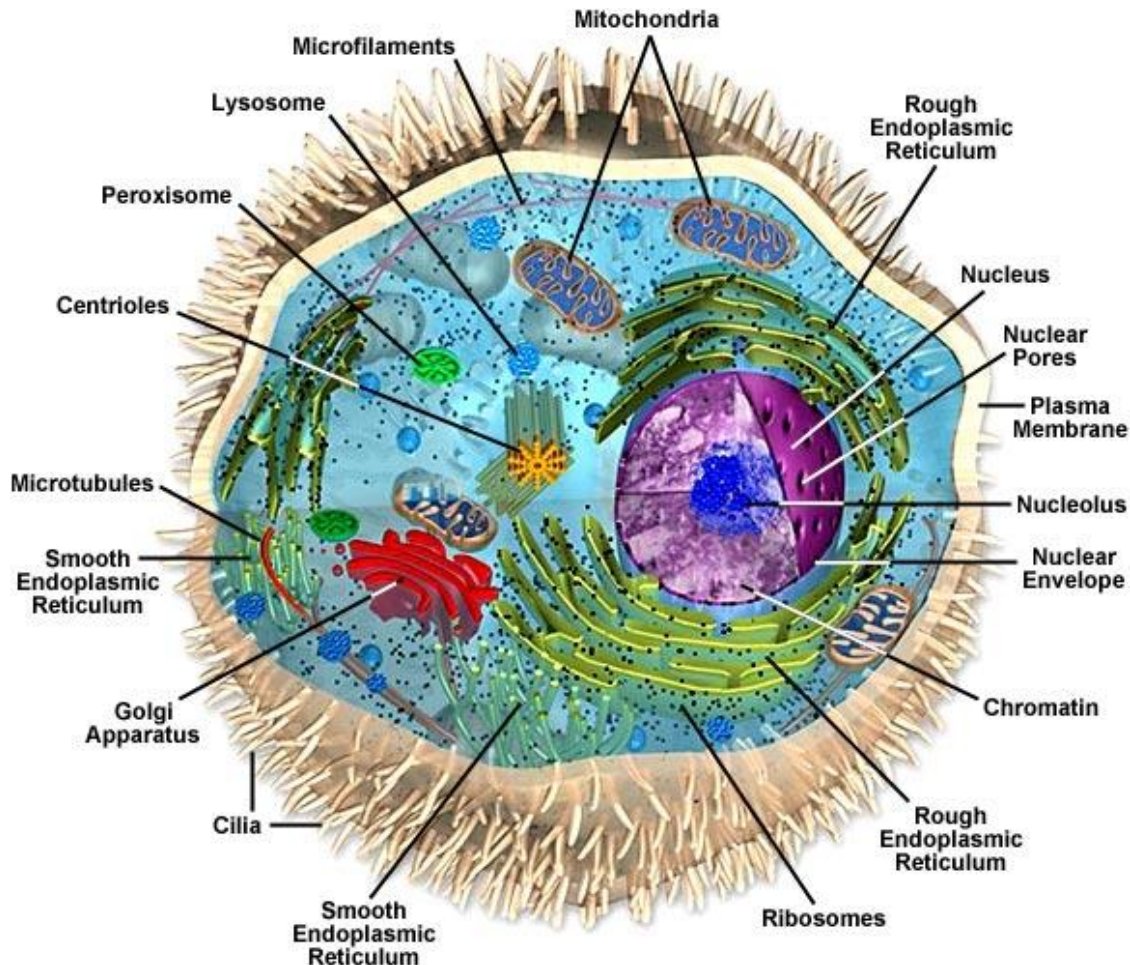
Degradation

- All biological materials degrade with time.
- Degradation is enhanced with:
 - nature of biological sample
 - substratum on which it is present
 - environmental conditions.

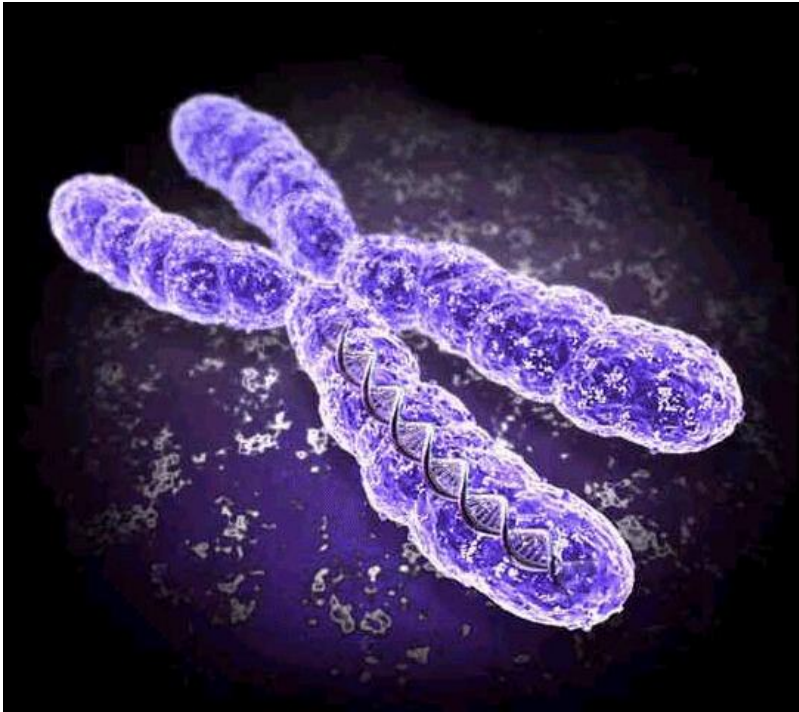
Degradation of Spermatozoa

- Non detection of human semen on the exhibits does not mean there was no sexual assault

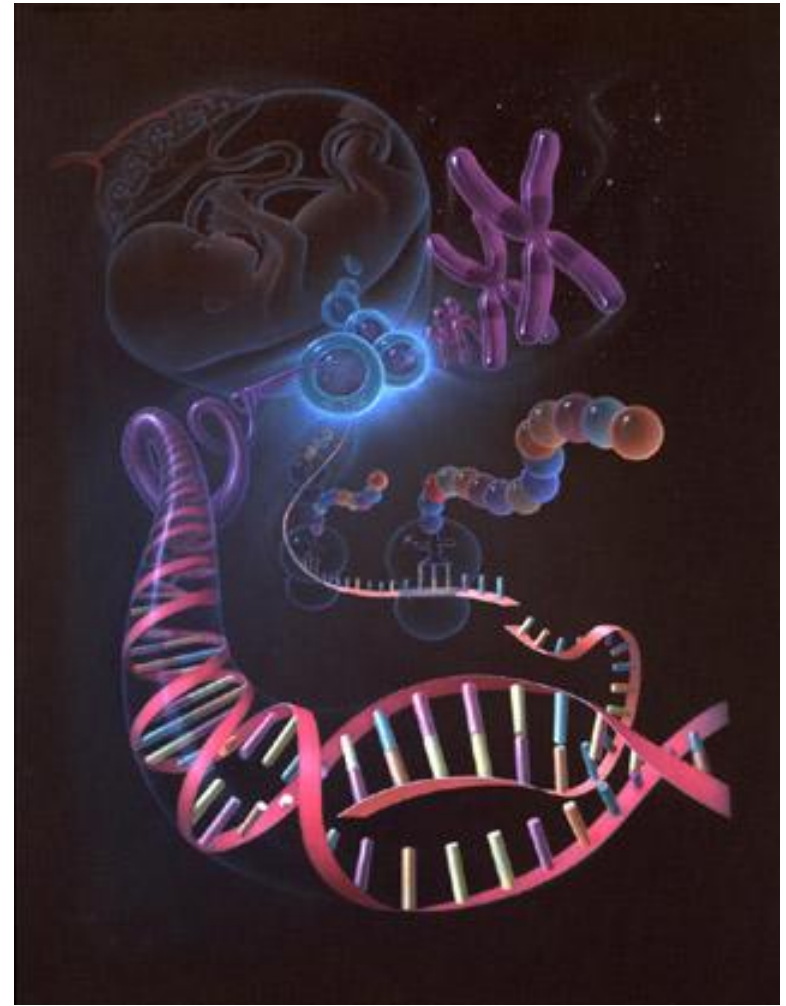
The Cell



- Human body has ~80- 100 trillion cells
- 23 Pairs of Chromosomes in nucleus of diploid human cell



Chromosome



DNA

DNA Structure

Double helix, anti-parallel
complementary strands,
super coiled.



Deoxyribonucleic Acid (DNA) is a polymer of deoxyribonucleotides.

Deoxyribonucleotide-

Sugar- Deoxyribose

Phosphate

Nitogenous base

Nitrogenous Bases

Purines
(Double Ring)

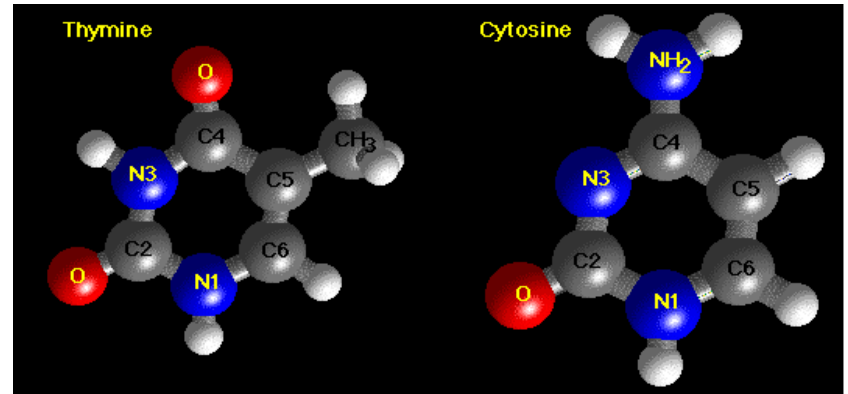
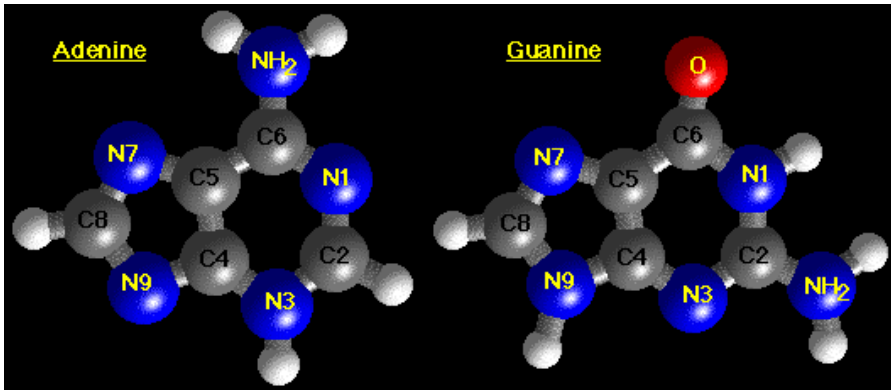
Pyrimidines
(Single Ring)

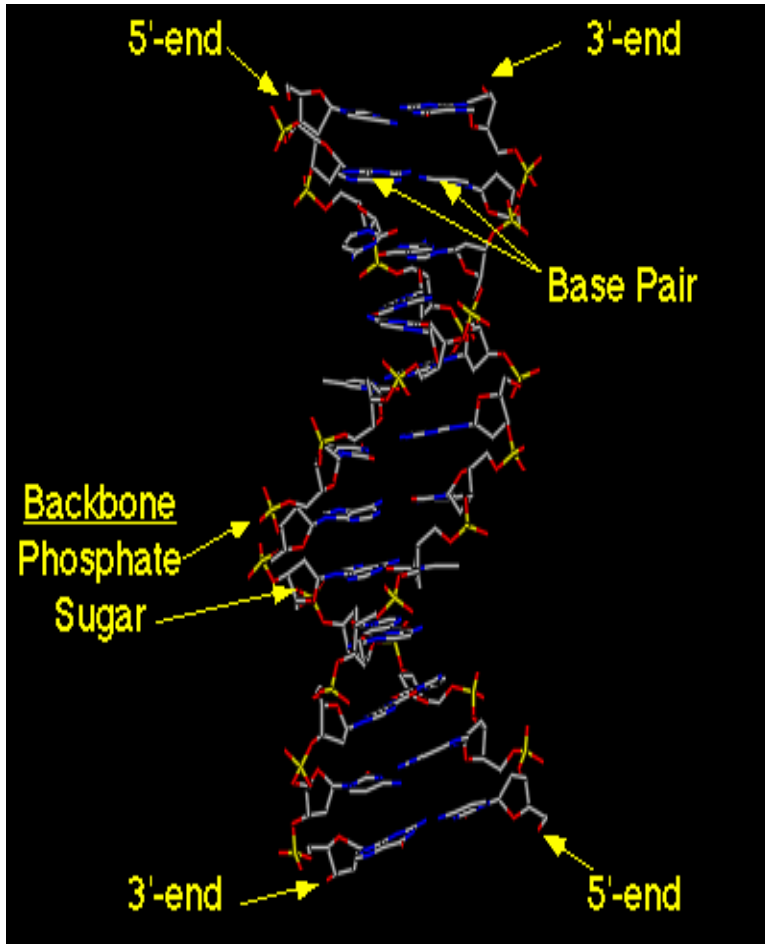
Adenine

Guanine

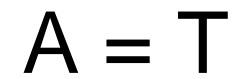
Thymine

Cytosine





- A combines with T

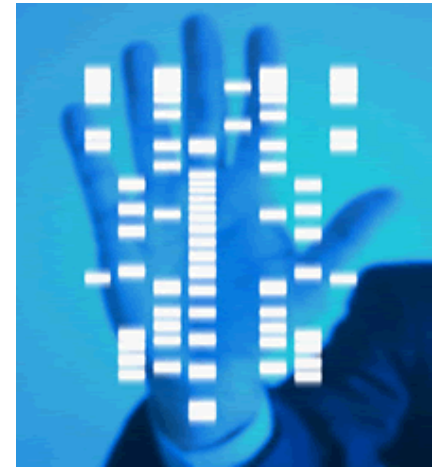


- G combines with C



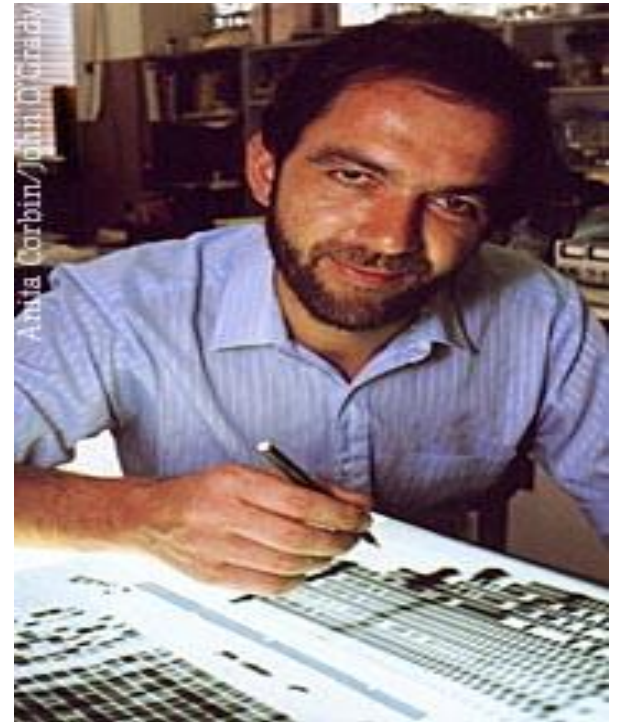
Basis of DNA Profiling

- DNA of **each individual is unique** (except monozygotic twins).
- DNA **is inherited from parents.**
- **Genetic variations** differentiate individuals.
- Current standard DNA tests **do not look at genes.**



September 15th, 1984:
Monday- 9AM

“We’d been looking for good genetic markers for basic genetic analysis and had stumbled on a way of establishing a human’s genetic identification. By the afternoon we’d named our discovery DNA Fingerprinting”



Sir Alec J Jeffreys

Ghanian Boy Immigration Case, 1985

First practical test of DNA Profiling involved 2 year struggle of Ms. Christiana Sarbah and her son Andrew to prove Home Office, England that they were indeed, mother and son.



Polymerase Chain Reaction (PCR)



“Sometimes a good idea comes to you when you are not looking for it. Through an improbable combination of coincidences, naivete and lucky mistakes, such a revelation came to me on Friday night in **April, 1983**”

Kary B. Mullis

In 1993, the Royal Swedish Academy of Sciences awarded the **Nobel Prize** in Chemistry to Kary B. Mullis for invention of PCR method.



Variations

Sequence Polymorphism

-----AGACTAGACATT-----

-----AGATTAGGCATT-----

Length Polymorphism

----- (AATG)(AATG)(AATG) -----

----- (AATG)(AATG) -----

Advantages of DNA Profiling

1. High discrimination potential

Random Match Probability:

ABO System	~ 1 in 3
20-24 STR Loci	~ 1 in 10^{20-25}
India's Population	~ 1.271×10^9
World Population	~ 6.973×10^9

Advantages of DNA Profiling

2. Highly **sensitive** technology

DNA Profiling is often feasible from degraded or **minute (even invisible)** amount of biological materials



Advantages of DNA Profiling

3. DNA molecule is more **stable** than blood groups & protein markers
4. DNA Profiling can be done from **any biological material** and is not restricted to any specific organ/ area of body, unlike dermal fingerprints
5. Species of **origin** and **gender** can also be determined

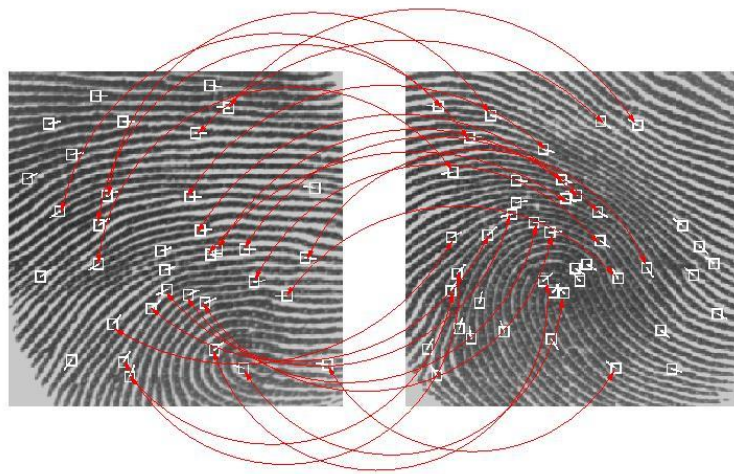
Advantages of DNA Profiling

6. Better administration of Justice:

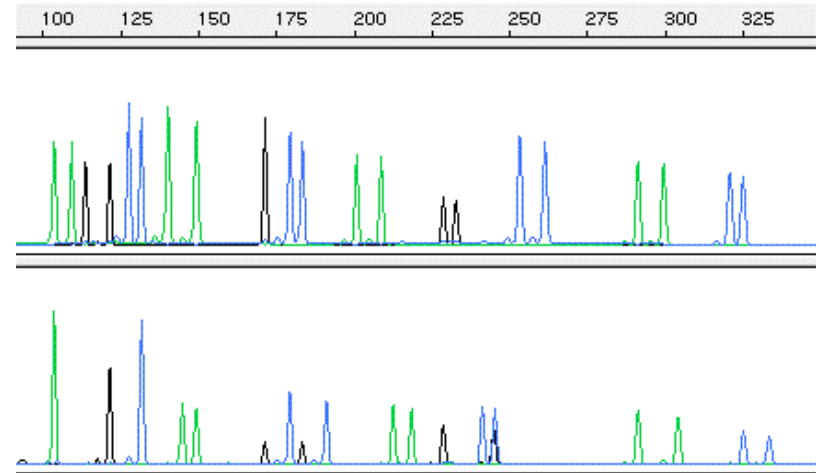
- a) cost-effective: Investigation time
& resources saved

- b) increased public confidence

Identifiers



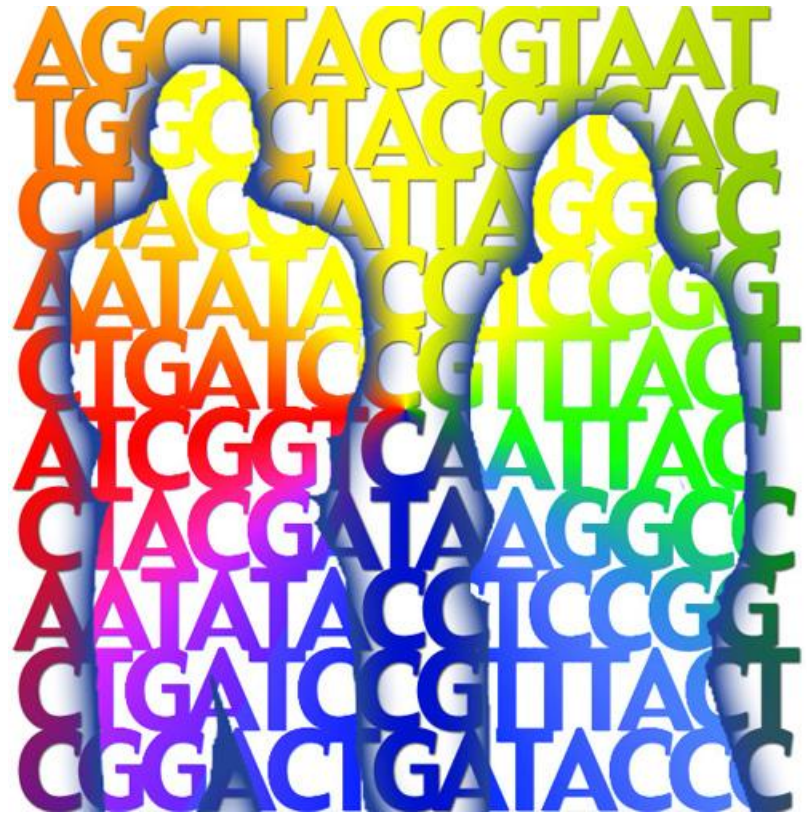
Fingerprints



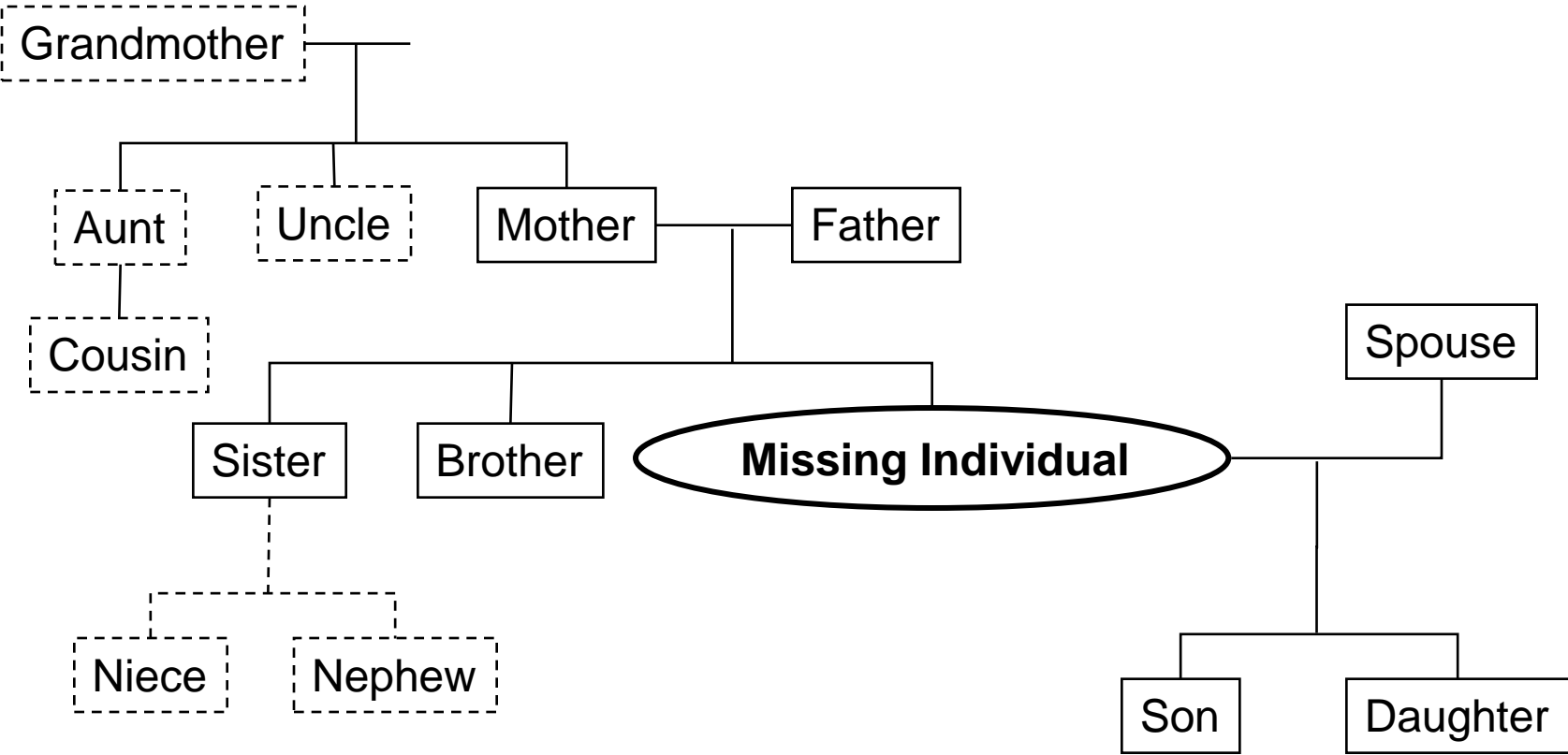
DNA

Human Identity Testing

- Forensic Cases
- Paternity Testing
- Missing Persons/Identity of Deceased
- Mass Disasters
- Historical Investigations
- DNA Databases
- Organ Transplantation



Kinship Analysis



Control Samples

Murder, physical assault, rape or sexual assault:

Control samples of **all suspects (s) & victim(s)**

Unidentified bodies/accident/mass disaster:

- a) Exclusive items of suspected deceased expected to carry his secretions of body cells like toothbrush, razor, comb, cap, unwashed clothing's etc
- b) control samples of **suspected deceased's parents**
- c) in case, one of the parent is not available for testing, control samples of brothers or sisters of suspected deceased along with surviving parent, or
- d) control samples of the **suspected deceased's spouse with children**

Parentage Disputes:

Control samples of child, putative mother and father

- Preferably 2mL blood should be collected by a **Doctor of Govt. Hospital** in a **vacutainer or sterilized tube**, with EDTA as anticoagulant. The vacutainer or tube should be transported in **refrigerated** condition.
- Alternatively, blood sample may be **completely dried on a clean sterilized gauge or filter paper**, sealed in **paper envelope** & transported at **room temperature**.
- Duly filled **Biological Sample Authentication Form** in duplicate



Gram (g)	A gram is 1/1000th of a kilogram
Milligram (mg)	The prefix "milli" means 10^{-3}
Microgram (μg)	The prefix "micro" means 10^{-6}
Nanogram (ng)	The prefix "nano" means 10^{-9}
Picogram (pg)	The prefix "pico" means 10^{-12}

Optimum Quantity of Human DNA Required for STR Analysis

HMW DNA for STR Analysis= 1 nanogram= 1ng

DNA in human diploid cell = 6 picogram= 6pg

DNA in human haploid cell= 3 picogram= 3pg

1ng= 1,000 pg

1ng DNA= ~167 Diploid Cells

1ng DNA= ~ 333 Haploid Cells

DNA Markers

- 15 STR markers (10+5) for European Union
(FGA, TH01, VWA, D8S1179, D18S51, D21S11, D3S1358, D16S539, D2S1338, D19S433, D12S391, D1S1656, D2S441, D10S1248 & **D22S1045**)
- 20 CODIS STR markers (13+7) for USA
(FGA, TH01, VWA, D8S1179, D18S51, D21S11, D3S1358, D16S539, **CSF1PO, TPOX, D13S317, D5S818, D7S820**, D2S1338, D19S433, D1S1656, D12S391, D2S441, D10S1248 & **DYS391**)
- Germany has another marker SE33
- China has another marker D6S1043

Methodology

- DNA Isolation from Biological Exhibits
- DNA Quantity Estimation
- Purification or Concentration of DNA
- Amplification
- Electrophoresis & Genotyping
- Interpretation of Results

Automated DNA Sequencer



DNA Profile



Three Possible Outcomes

Non- Match: Exclusion

Match: Estimate Probability

Inconclusive: No decision

PERSONAL IDENTIFICATION

Marker	Exhibit A1: Shirt	Exhibit A2: Banian	Exhibit D: Blood Sample I <small>(Father of suspected deceased)</small>	Exhibit E: Blood Sample II <small>(Mother of suspected deceased)</small>
D8S1179	15	15	10, 15	10, 15
D21S11	30, 30.2	30, 30.2	30, 32	30.2
D7S820	7, 10	7, 10	7, 10	10
CSF1PO	12	12	11, 12	12, 13
D19S433	14.2, 17.2	14.2, 17.2	14, 17.2	13, 14.2
VWA	17, 18	17, 18	14, 17	18, 19
TPOX	8, 10	8, 10	7, 10	7, 8
D18S51	15, 20	15, 20	15, 20	15, 20
D3S1358	15, 17	15, 17	15, 16	17
TH01	6, 9.3	6, 9.3	6, 9.3	6, 7
D13S317	8, 11	8, 11	8	8, 11
D16S539	10, 14	10, 14	10, 11	10, 14
D2S1338	19, 23	19, 23	22, 23	19, 23
D5S818	11, 13	11, 13	11, 12	12, 13
FGA	17.2, 23	17.2, 23	20.2, 23	17.2, 23
Amelogenin	XY	XY	XY	XX

PATERNITY DETERMINATION

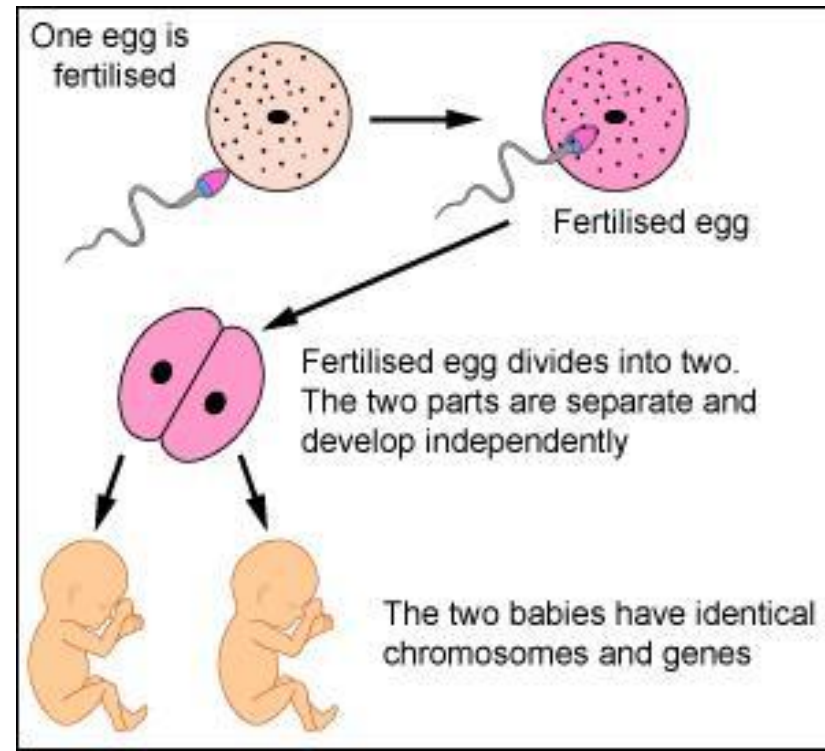
Marker	Exhibit A: Blood Sample I (Alleged Father)	Exhibit B: Blood Sample II (Mother)	Exhibit C: Blood Sample III (Baby)
D8S1179	10, 16	12, 14	12, 16
D21S11	32.2, 33.2	30	30, 33.2
D7S820	8, 10	8, 11	8, 10
CSF1PO	10, 11	11, 12	11, 12
D19S433	13	13.2, 15	13, 13.2
VWA	14, 17	16, 17	14, 16
TPOX	8	8, 11	8
D18S51	15	13, 16	15, 16
D3S1358	15, 18	15, 17	15, 18
THO1	7, 9	9, 9.3	7, 9.3
D13S317	8, 12	8, 12	8, 12
D16S539	9, 12	11, 13	12, 13
D2S1338	23, 24	19	19, 24
D5S818	11, 12	10, 11	10, 11
FGA	25, 26	19, 23	19, 26
Amelogenin	XY	XX	XX

Technical Limitations

- Highly Degraded Samples

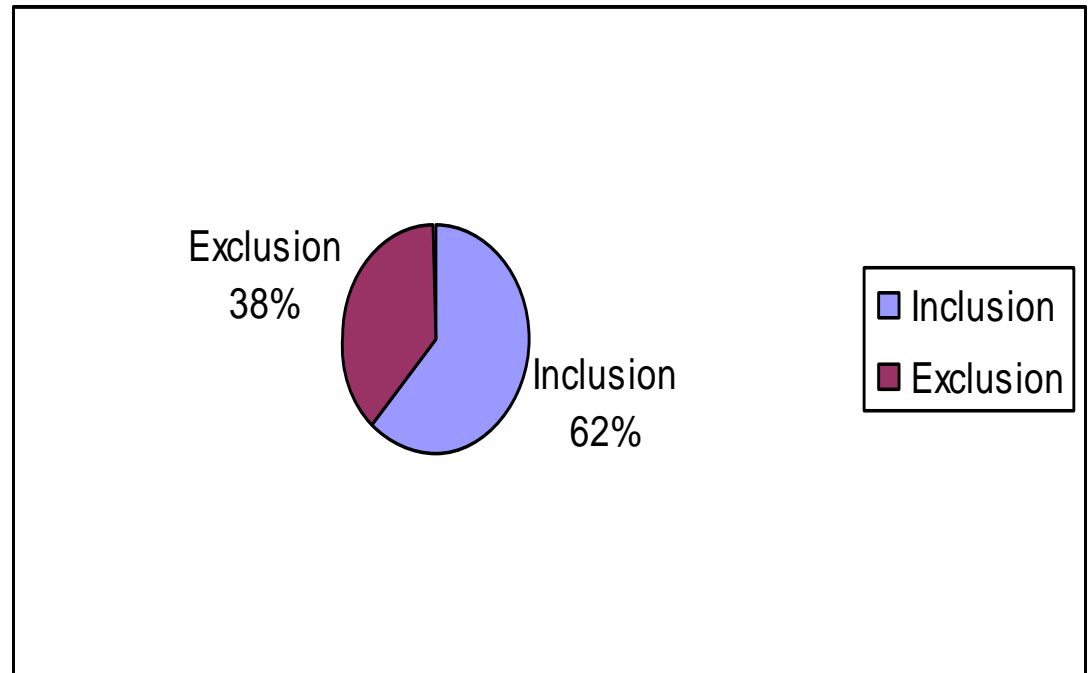
(Bones, Nails, Hair etc)

- Inhibitors
- Contamination
- Monozygotic Twins
- Full Siblings, rarely



Paternity Cases with Single Suspect

Total Cases = 52
Inclusion = 32
Exclusion = 20



Assumptions

1. Reference samples belong to the persons they are attributed to.
2. Donors of samples have the same biological relationship with the person in question, as assumed.

However, such assumptions do not hold true in some exceptional situations and pitfalls should be clearly understood while collection or analysis of reference samples.

Authentic Reference Samples

History of sample swapping is as old as use of DNA profiling in criminal cases. Any change in the control samples or fudging will lead to erroneous results. If investigated properly, sample swapping can be identified easily.

Biological Relationships, sometimes, do not follow Social or Legal norms

- Artificial Reproductive Technologies (ARTs)
- False Paternity
- Child Swapping
- Step Relations/Adoptions



Major Limitation in Case Work

- Improper
 - » Selection
 - » Collection
 - » Preservation
 - » Packing
 - » Transportation



Collection & Preservation of Evidence

- If chain of custody is not properly documented, its origin can be questioned
- If evidence is not properly collected, biological activity can be lost
- If it is not properly packaged, contamination can occur
- If it is not properly preserved, decomposition and deterioration can occur

Possible Location of Evidence

- Pubic region
- Bite mark or licked area
- Fingernail scrapings
- Condom

- Clothing's, blankets, sheets, pillows
- Hat, mask, gag
- Cigarette butt
- Drinking vessels
- Weapon, bullet
- Postage stamps/Envelope flaps

Source of DNA

Semen, Hair
Saliva
Blood or Skin Cells
Semen (inside),
Vaginal secretions (outside)
Blood, Semen, Saliva, Hair
Skin Cells, Saliva, Hair
Saliva
Saliva
Blood
Saliva

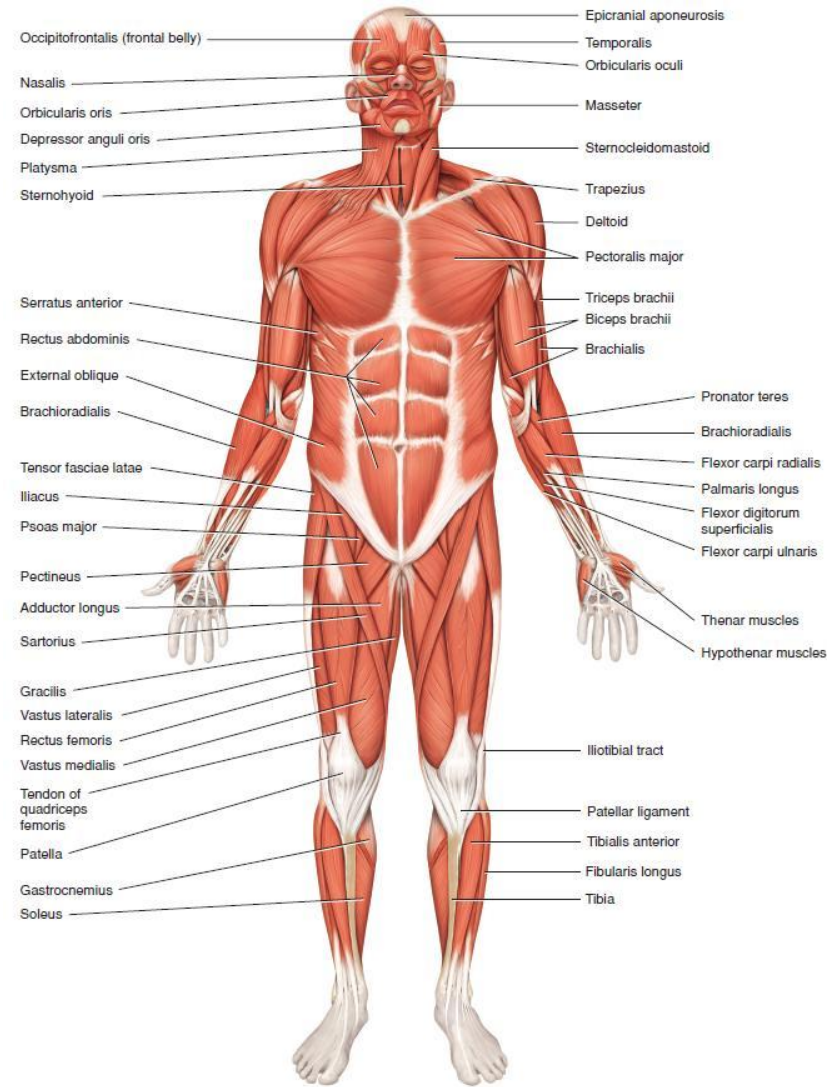


Guidelines for Medico- Legal Experts

- Soft tissue should be collected in suitable clean plastic container having **saturated salt solution** and refrigerated. Avoid using glass container as they may break.
- **Tissues should never be preserved in Formalin.**

Guidelines for Medico- Legal Experts

- In case of mass disasters, accidents, burnt or mutilated bodies; **2-3 tissues like deep skeletal muscle, skin or other least affected tissue (about 5g)** should be collected during autopsy in clean & sterilized plastic containers and transported in refrigerated condition.



(a) Anterior view

Guidelines for Medico- Legal Experts

- **Post- mortem blood** should be transferred as **dried stain on sterile gauge or filter paper.**
- When only skeletal remnants are available, **teeth and long bones (femur or humerus)** should be preferred.
- **Foetal and maternal tissues** must be **separated** at the time of collection.

Guidelines for Medico- Legal Experts

- The **vaginal swab or smear** on slides in sexual assault cases should be **properly dried** & packed separately.
- If blood, semen or saliva stains are found on a body, moisten a cotton swab and **swab** the area thoroughly applying light pressure. Dry the swab properly and pack.
- If hair is located, collect it with the forceps, avoid touching the hair root region and mount it on glass slide for preserving hair root.



Guidelines for Investigating Officers

- The exhibit should be collected, handled and stored to preserve its identity, integrity, condition and security. A well-documented **chain of custody** should be maintained from the time the exhibit is first collected.
- The biological materials contain **infectious agents**. Direct contact with them should be avoided by wearing gloves, masks or other appropriate protective devices.

Guidelines for Investigating Officers

- **Wear gloves** while collection of specimen and **avoid contamination** of the different specimen with one another.
- **Change gloves** after collection of every evidence to avoid cross-contamination.



Guidelines for Investigating Officers

- Each exhibit should be packed separately in **paper envelope** or card board box and sealed properly.
- Details regarding case no., date, P.S., name and signature of exhibit collector should be written over all packets.
- **Liquid blood**, if found at the scene, should be collected on a piece of **sterile filter paper, cotton or gauge, dried in sunshade**, and then packed. Similarly **wet garments** should be properly **dried** and packed.



Guidelines for Investigating Officers

- Body fluid stains on **objects too large** to transport, **fixed or non-absorbent surfaces** should be **scrapped** with a sterilized blade or scalpel. The scrapings should be collected in a clean sheet of paper and placed in an envelope.
- If evidence is found on an **absorbent surface**, **cut the area** and pack.
- Transfer **fresh blood, tissues** to laboratory in **refrigerated** conditions at the earliest to minimize degradation.



Guidelines for Investigating Officers

- **Swab** the beverage containers with a moisten cotton swab, **dry** and pack.
- The **inner** and **outer** surfaces of the **condom** should be **swabbed separately, dried** and packed.
- Do inform about the **claims** made by victim(s) & suspect(s) regarding the source of the biological clue materials.



Guidelines for Investigating Officers

- Please inform whether the exhibits bearing biological clue material were **laundered or diluted** with other body fluids.
- Information regarding the victim(s)' and suspect(s)' **health**, such as **AIDS, hepatitis** etc. should be sent.
- Details about the donor's **blood transfusion or organ transplantation** should be mentioned.
- Always collect the control blood sample along with duly filled '**Blood Sample Authentication Form**' in duplicate.

Guidelines for Investigating Officers

- Do not touch any exhibit with bare hands.
- Do not collect different exhibits wearing same glove.
- Do not cough or sneeze over the area expected to carry biological clue material.
- Do not pack biological exhibits in polythene envelopes or airtight containers. Use paper envelopes or card board boxes.
- Do not expose the evidence material to heaters, fans or intense light sources.

DNA Databases

21st Century Crime Fighting Tool

- Contain the DNA profiles of the convicts or arrestees as per DNA Act in the country.
- A habitual offender may indulge in crime after release from imprisonment and can be identified by comparing DNA profile of his biological specimen found at the scene with his genetic information already available in the Database.

DNA Database

- Establishment of an effective DNA database requires time and full cooperation between:
 - a. policy makers
 - b. law enforcement agencies
 - c. forensic DNA laboratories

Databank & Database

- DNA Databank- Collection of Biological samples (blood or oral swab) or their DNA of arrestees an/or convicts.
- DNA Database- Collection of DNA profiles of arrestees and/or convicts for comparison purpose.

Advantages of DNA Database

- Connecting:
 - Individual(s) to site(s)
 - Individual(s) to different crimes
 - Serial crimes
 - Cases without initial suspects
- Larger databases are more effective

INTERPOL Survey

- More than 120 countries are using DNA profiling in criminal investigations.
- 54 of them have already established the national DNA database to net the offenders.

(INTERPOL Global DNA Profiling Survey, 2008)

National DNA Database (NDNAD)

- 1995- UK was the first country to establish DNA database
- **Markers-** 6 SGM STR loci (FGA, TH01, VWA, D8S1179, D18S51, & D21S11)
- 1999- 10 STR loci (6 SGM plus D3S1358, D16S539, D2S1338, & D19S433)
- 2009- The European Union voted for 5 additional loci (D12S391, D1S1656, D2S441, D10S1248, & D22S1045)

National DNA Database (NDNAD)

- 2004- Databased the “entire active criminal population”
- Since 2004, the police in England and Wales have been able to take DNA samples without consent from anyone arrested on suspicion of any recordable offence. Recordable offences include begging, being drunk and disorderly and taking part in an illegal demonstration
- Nearly 10% of the UK's population (about 6 million people) is on the NDNAD

Combined DNA Index System (CODIS)

- 1998- FBI officially launched nationwide DNA database for law enforcement agencies
- CODIS- Software and hardware to connect laboratories
- DNA database of US operates at 3 levels:
 - NDIS- National DNA Index System
 - SDIS- State DNA Index System
 - LDIS- Local DNA Index System

Combined DNA Index System (CODIS)

- No names or other personal identifiers of the offenders, arrestees, or detainees are stored. Only the following information is stored and can be searched at the national level:
 - ❖ (1) The DNA profile
 - ❖ (2) The Agency Identifier of the agency submitting the DNA profile
 - ❖ (3) The Specimen Identification Number—generally a number assigned sequentially at the time of sample collection. This number does not correspond to the individual's social security number, criminal history identifier, or correctional facility identifier; and
 - ❖ (4) The DNA laboratory personnel associated with a DNA profile analysis

Combined DNA Index System (CODIS)

- All 50 states in US have enacted legislation to establish a DNA database containing profiles from convicted persons and/or arrestees of specific crimes
- Growing number of states are entering DNA profiles from those arrested and accused for certain crimes

Privacy & Security Issue

- Information stored in DNA samples contain genetic information that could be used against an individual or his or her family if not handled properly
 - Forensic STR loci do not have any association with a genetic disease or any genetic predisposition
 - Names of individuals or other features are not stored with the DNA profiles
 - Data are encrypted and shared through a secure network only accessible to designated administrators
 - Penalties for improper use of DNA samples include fines and possible imprisonment

Sample Retention Issue

- DNA sample from the offender is retained after a DNA profile has been generated from the sample.
- **After getting a hit from the database, the sample is retested as it is necessary to have the original sample to confirm the profile.**
- Keeping in mind the technology advancements in future, **retained sample can be analysed with new genetic markers or assays** to enable better recovery of information from forensic samples.

Sample/DNA Profile Expungement

- If an arrested and/or convicted individual is later cleared of the charges, he/she may want his/her DNA profile removed from the database and the DNA sample destroyed or returned from the databank.
- The individual is typically asked to write to the law enforcement agency to request the removal of his/her DNA profile and the destruction/return of the DNA sample, and to provide appropriate documentation to support his/her request.

DNA Profiling Bill

- Govt. of India gave responsibility of framing bill for DNA Database to Deptt of Biotechnology (Centre for DNA Fingerprinting & Diagnostics, Hyderabad) in December, 2003.
- 'DNA Profiling Advisory Committee (D-PAC)' was constituted.

Indices

- » Crime scene index
- » Suspects' index
- » Offenders' index
- » Missing persons' index
- » Unknown deceased persons' index
- » Volunteers' index
- » Other indices as may be specified by DNA Profiling Board

DNA Profiling Board

- Constitution, Power & Functions
- Approval of DNA labs
- Standards, QC, QA & obligations of DNA lab
- Infrastructure & training for DNA lab
- DNA databank
- Confidentiality, access to DNA profiles, samples & records
- Offences & penalties
- Powers of Central Govt. to supersede DNA Profiling Board
- List of offences
- Sources of collection of samples for DNA test

The Debbie Smith Act of 2004

- March 3, 1989- A man wearing a ski mask entered Debbie Smith's Virginia, home, threatened her with a gun, blindfolded and raped her repeatedly.
- She participated in the collection of DNA evidence for a rape kit, but it was not formally tested and entered into a national database until 1994.
- July 24, 1995- A DNA technician identified Debbie's attacker, Norman Jimmerson and was sentenced to 161 years in prison.



Ms Debbie Smith
Victim Advocacy

The Debbie Smith Act of 2004

- Federal funding to perform DNA testing of backlogged samples.
- Initially approved by Congress in 2004 and renewed in 2008.
- From 2005 to 2009, the US government committed over \$150 million per year for backlog reduction.

HUMAN GENETICS

Finding Criminals Through DNA of Their Relatives

Frederick R. Bieber,^{1*} Charles H. Brenner,² David Lazer³

Analyses of the DNA databases maintained by criminal justice systems might enable criminals to be caught by recognizing their kin, but this raises civil liberties issues.

- The DNA Profiles showing no-match in Database are searched for probable presence of any close relative.

Familial Searching

- Developed by FSS, UK, this technology has been used to solve a number of cases, but not without controversy.
- Familial searching is based on the concept that first-order relatives, such as siblings or parent/child, will share more genetic data than unrelated individuals.

Familial Searching

- In US, no familial searching is currently performed at the National DNA Index System.
- June 2011- California, Colorado, Texas and Virginia were performing familial searching.

Prum Treaty

- 2007- The European Union adopted the above mentioned treaty requiring all the member countries to exchange DNA profile information.

Interpol Gateway

- 2002- Interpol has established a platform for exchange of data called the “DNA Gateway”. The database was initiated with a single DNA profile but, by the end of 2012, it contained more than **136,000** DNA profiles contributed by **67 member countries**.
- Interpol Standard Set of Loci (ISSOL)- 7 STR loci plus an optional locus.

Universal DNA Database?

DNA-Prokids

- DNA-Prokids is an international project aimed at fighting against traffic in human beings using genetic identification of victims and their families, especially in children.
- Upon suggestion of the UGR Genetic Identification Laboratory, an international project for genetic identification of missing children and their families was set up in 2004. The goal was to not limit the scope of research to domestic crimes, but to spread results worldwide with the aim of boosting the international fight against human trafficking.

DNA-Prokids

- No profit organization
- Apart from Spain & US, other participants in this project are Brazil, Guatemala, Mexico, China, Indonesia, Nepal, Phillipines, Thailand, Sri Lanka along with UN Global Initiative to Fight Human Trafficking (UN GIFT).

Innocence Project

The screenshot shows the website for The Innocence Project. At the top, the browser address bar displays www.innocenceproject.org. The site header includes the logo, a search bar with a Google Custom Search button, and a "Get E-mail Updates" button. A navigation bar contains links for "KNOW THE CASES", "UNDERSTAND THE CAUSES", "FIX THE SYSTEM", "ABOUT", "DONATE", and "NEWS & RESOURCES".

The main content area features a featured case for Orlando Boquete, a man with a shaved head, with the text: "Orlando Boquete Misidentified and wrongfully convicted in Florida in 1982." Below this, it states "December 9, 2014" and "321 EXONERATED". A language selector for "Español" is also present.

Below the main content, there are three promotional boxes:

- "SHOP for the Innocence Project" featuring a red t-shirt with the logo.
- "THE INNOCENCE BLOG Updated Daily" with a background of legal terms like "test court", "exon", "DNA", "eyewitness", "cells", and "dna".
- "Congress Needs to Reauthorize the Justice for All Act" featuring a woman's portrait.

At the bottom, there are social media links for "Follow Us On Twitter" and "Get Email Updates". A Facebook "Like" button shows "101,001 people like this. Sign Up to see what your friends like." The footer contains the URL www.capwiz.com/innocenceproject/issues/alert/?alertid=63932631&type=CU.

Innocence Project

Leading causes of Wrongful convictions:

- Eyewitness misidentification testimony
- Unvalidated or improper Forensic Science
- False confessions and incriminating statements
- Unreliable informants

First DNA Case in India



- To determine paternity of son of Ms E Vilasini
- DNA evidence submitted by Dr Lalji Singh of CCMB, Hyderabad was accepted by CJM, Telicherry (Thalassery), Kerala
- Verdict challenged, upheld by Kerala High Court

First DNA Verdict in India

- Verdict announced on April 24th, 1990:

“PW4 is an expert in the matter of molecular biology and the evidence tendered by him is quite convincing and I have no reason why it should not be accepted. Just like the opinion of a chemical analyst or like the opinion of a fingerprint expert, opinion of PW4, who is also an expert in the matter of cellular and molecular biology, is also acceptable.”

Goutam Kundu vs State of West Bengal (1993)

Supreme Court of India

- (1) that courts in India cannot order blood test as matter of course
- (2) wherever applications are made for such prayers in order to have roving inquiry, the prayer for blood test cannot be entertained.
- (3) There must be a strong prima facie case in that the husband must establish non-access in order to dispel the presumption arising under section 112 of the Evidence Act.
- (4) The court must carefully examine as to what would be the consequence of ordering the blood test; whether it will have the effect of branding a child as a bastard and the mother as an unchaste woman.
- (5) No one can be compelled to give sample of blood for analysis.**

Sharda vs Dharmपाल (2003)

Supreme Court of India

1. A matrimonial court has the power to order a person to undergo medical test.
2. Passing of such an order by the court would not be in violation of the right to personal liberty under Article 21 of the Indian Constitution.
3. However, the court should exercise such a power if the applicant has a strong prima facie case and there is sufficient material before the court. **If despite the order of the court, the respondent refuses to submit himself to medical examination, the court will be entitled to draw an adverse inference against him.”**

Kamti Devi vs Poshi Ram (2001),
Amarjit Kaur vs Harbhajan Singh (2003)
Banarsi Dass vs Teeku Dutta (2005)

Supreme Court of India

Gave priority to social parentage over biological parentage and thereby rejected DNA evidence by observing that **though the result of a genuine DNA test is said to be scientifically accurate** it is not enough to escape from the conclusiveness of Section 112 of the Evidence Act, 1872.

THE CODE OF CRIMINAL PROCEDURE (AMENDMENT) ACT, 2005

- **Insertion of new section 53A.** Examination of person accused of rape by medical practitioner.
- (2) **The registered medical practitioner conducting such examination shall, without delay, examine such person and prepare a report of his examination giving the following particulars, namely:-**
 - (i) the name and address of the accused and of the person by whom he was brought,
 - (ii) the age of the accused,
 - (iii) marks of injury, if any, on the person of the accused,
 - **(iv) the description of material taken from the person of the accused for DNA profiling, and**
 - (v) other material particulars in reasonable detail.

The Code of Criminal Procedure (Amendment) Act, 2005

Amendment of Section 53

- (a) "examination" shall include the examination of blood, blood stains, semen, swabs in case of sexual offences, sputum and sweat, hair samples and finger nail clippings by the use of modern and scientific techniques including DNA profiling and such other tests which the registered medical practitioner thinks necessary in a particular case;

The Code of Criminal Procedure (Amendment) Act, 2005

Insertion of new Section 53A

Examination of person **Accused** of rape by medical practitioner.

- (2) The registered medical practitioner conducting such examination shall, without delay, examine such person and prepare a report of his examination giving the following particulars, namely:
- (i) the name and address of the accused and of the person by whom he was brought,
 - (ii) the age of the accused,
 - (iii) marks of injury, if any, on the person of the accused,
 - (iv) **the description of material taken from the person of the accused for DNA profiling**, and
 - (v) other material particulars in reasonable detail.

The Code of Criminal Procedure (Amendment) Act, 2005

Insertion of new Section 164A

Medical examination of the **Victim** of rape

- (2) The registered medical practitioner, to whom such woman is sent, shall, without delay, examine her person and prepare a report of his examination giving the following particulars, namely:—
- (i) the name and address of the woman and of the person by whom she was brought;
 - (ii) the age of the woman;
 - (iii) the description of material taken from the person of the woman for DNA profiling;**

Murder	33,201
Attempt to Murder	35,417
CH not amounting to Murder	3,380
Rape	33,707
Un-identified Bodies	38,821

Persons arrested under IPC crimes 35,22,577

No data about- Civil Paternity Suites
Wildlife Cases
Miscellaneous Cases

Human DNA Profiling Facilities in India

27 Forensic Human DNA Profiling Laboratories

- Central Forensic Science Laboratories, Kolkata, Chandigarh & Hyderabad
- Central Forensic Science Laboratory, CBI, New Delhi
- Centre for DNA Fingerprinting & Diagnostics, Hyderabad
- State Forensic Science Laboratories
 - North: Karnal (Haryana), Dehradun (Uttarkhand), Junga (HP), New Delhi (Delhi)
 - East: Patna (Bihar), Ranchi (Jharkhand), Bhubaneswar (Odisha)
 - Northeast: Guwahati (Assam), Agartala (Tripura)
 - Centre: Lucknow (UP), Sagar (MP),
 - West: Jaipur (Rajasthan), Gandhinagar (Gujarat), Mumbai (Maharashtra)
 - South: Hyderabad (Telengana), Bangalore (Karnataka), Chennai (Tamil Nadu), Thiruvananthapuram (Kerala)
- Regional Forensic Science Laboratories: Surat (Gujarat), Nagpur & Pune (Maharashtra), Madurai (Tamil Nadu)

Wild Life DNA Profiling Facilities in India

- Laboratory for the Conservation of Endangered Species (LaCONES), Centre for Cellular & Molecular Biology (CCMB), Hyderabad
- Wildlife Institute of India (WII), Dehradun

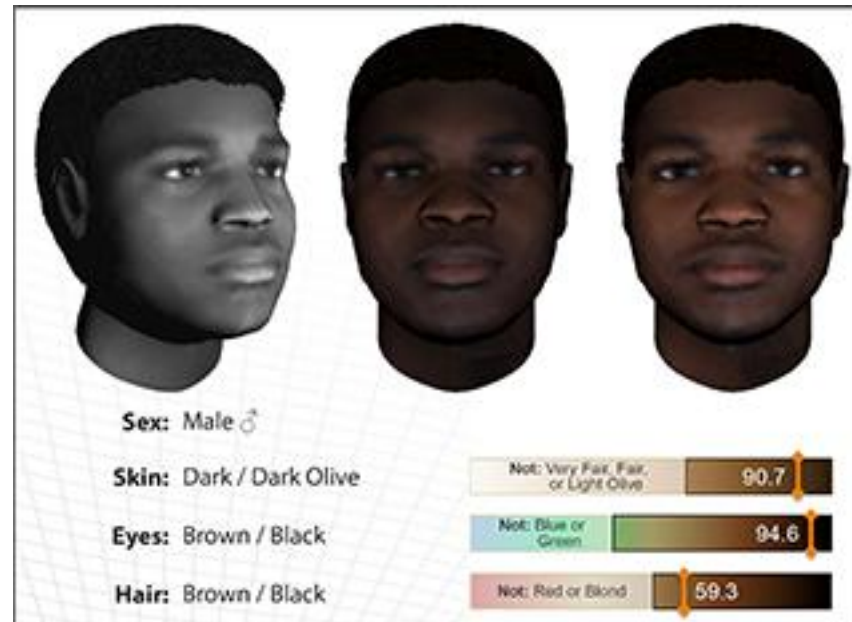
Dad ordered to pay child support for just one twin after DNA test reveals other baby was fathered by someone else

- **A New Jersey judge has ruled that a man only has to pay child support for one twin girl after a DNA test showed he was not the other's father**
- **A mother can conceive babies from different fathers if she has sex with two men in the same week and an egg is fertilized by each one**
- **The judge only found two other similar paternity cases across the country**

By ASSOCIATED PRESS and DAILYMAIL.COM REPORTER

PUBLISHED: 19:37 GMT, 7 May 2015 | UPDATED: 15:52 GMT, 8 May 2015

First DNA-Phenotyped Image of 'Person of Interest' in Double Homicide



Snapshot composite of a person-of-interest released January 9, 2015, by the Columbia SC Police Department. Because age is not predictable from DNA, this person may appear older than shown here.

Parabon NanoLabs, Inc.

Issues

- » Legislation
- » Infrastructure
- » Trained manpower
- » QA/QC

DNA Finger Printing has risen like a new star in the horizon of Law. Let us catch its shine before it is too late and be ready for tomorrow.

Kerala High Court, Ernaculum
Geetha Vs The State of Kerala & Ravi (2002)