Forensic Evidence in Civil Cases

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Proposed Scope for Discussion

- Application of scientific methods and techniques in administration of justice
- Locard's Principle of Exchange
- DNA Profiling
  - Evidentiary value
  - Emerging technologies in DNA Profiling
- Common challenges before the Court
  - Chain of custody
  - Privacy and Ethical concerns

Application of scientific methods and techniques in administration of justice

Discerning the ‘truth’ in a dispute is an age-old challenge for those assigned the onerous responsibility of ‘judging’…

The essence of this challenge has been lucidly spelt in the Tamil literature ‘Thrukkural’ by the sage scholar Thiruvalluvar…

எப்பொருள் எத்தன்மைத் தாயினும் அப்பொருள்
மெய்ப்பொருள் காண்பது அறிவு.

Epporul Eththanmaith Thaayinum Apporul
Meypporul Kaanpadhu Arivu — (Transliteration)

True knowledge is the perception concerning every thing of whatever kind, that that thing is the true thing

The challenge: What means can enable one in reaching the truth…

Forensic science has proven reliable in meeting out the above challenge over the past century.

Regarding the challenge relating to achieving the true knowledge concerning material objects that relate to a crime Locard's principle and the consequent material objects (physical evidence) collectable from a crime scene and analysable in a Forensic Science Laboratory – popularly termed 'physical evidence' have proven useful.

In addition to 'collectable' physical evidence from a crime scene, those physical evidence that are 'observable' from the scene have also been shown as useful.

Obviously, those physical evidence 'observable' in a crime scene cannot be transported to the laboratory.

Truth vs. Fact

Truth:

- It is the ground truth relating to an incident.
- It remains unchanged during the three periods of time – past, present and the future.
- It does not exist as an observable physical something.
- It can only be inferred and thus cannot be tested for repeatability or by framing hypothesis.

Fact:

- In science, facts are those that have 'physical' existence
- 'Physical evidence' that are seen in crime scenes are facts.
- 'Physical evidence' are 'collectable' from crime scenes – e.g. bloodstains.
- 'Physical evidence' are portable to the laboratory and analyzable.
- There are some physical evidence that are merely 'observable' – e.g. bloodstain patterns, burn patterns.

Inferring the 'truth' from scientific 'facts'

Fact:

- 'Physical evidence' collectable from crime scenes are 'facts' and can be 'identified' and 'compared' with relevant known samples leading to 'association'.
- 'Physical evidence', once associated enable arriving at 'strong inference'.
- Physical evidence that are merely observable in crime scenes such as bloodstain patterns, burn patterns, pellet patterns etc. enable framing hypothesis and testing them – another method in science for arriving at 'strong inference'.
- Strong inferences when conjoined together enable 'reconstruction of crime' or 'crime scene reconstruction'.

Locard's Principle:

Locard's principle explains the transfer of physical evidence during the commission of crimes.

The first question in crime investigation: How it could have happened?

'Ground reality' or 'factual reality' – victim only knows…

"Truth" for law is a legal construct which relates to facts as they emerge at trial.

Such "truth" does not necessarily coincide with reality'

– Quote from Deed (1991) in Fulero and Wrightsman (2009).

'Legal truth' may not be the same as 'ground truth'

But "legal truth" and "ground reality" should be closer to each other… should never oppose each other…

Example: It should not project a case of 'suicide' as 'homicide'

Evidence: Anything that tends to prove or disprove a fact at issue in a legal context

Testimonial Evidence: Oral or "spoken" evidence presented by witnesses who come into court to give their testimony under oath. **Witness has no need to give reasons for his opinions.**

Issues in testimonial evidence:
a) He has no need to give reasons
b) Can perjure

Scientific Evidence: Evidence that has a **scientific or highly technical basis**, which requires an expert witness with specialized knowledge **to assist the trier of fact to understand it** (Thomas Buckles, 2003). **The expert needs to give reasons for his opinions.**

Advantages in scientific evidence:
a) Based on demonstrative reasons
b) Cannot perjure itself

Conceptual Foundations in Forensic Science:

- Locard's principle of exchange
- The principle of identification
- The principle of individualization
- The principle of reconstruction

1. LOCARD'S PRINCIPLE OF EXCHANGE

Definition: 'No one can act (commit a crime) with the force (intensity) that the criminal act requires without leaving behind numerous signs (marks) of it; either the wrong-doer (felon, malefactor, offender) has left signs at the scene of crime, or on the other hand, has taken away with him—on his person (body) or cloths—indications of where he has been or what he has done' (Inman and Rudin, 2001) .

The occurrence of physical evidence:

Transfer of traces (that form 'physical evidence') occurs at the crime scene when two objects contact with each other.

QUALITY OF PHYSICAL EVIDENCE

Quality of physical evidence: *'Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only human failure to find it, study and understand it, can diminish its value'* (Kirk, 1974)

Locard's principle accounts for

a) the occurrence of transfer of traces in the form of physical evidence when two objects contact each other and
b) the ability of the examiner to discern signs (marks) of the transfer (such as finger marks) (Inman and Rudin, 2001; Saferstein, 2019)

Identification of physical evidence:

Once the transfer of physical evidence is established, analysis of that evidence leads to identifying the type of the evidence.

Conceptual Foundations in Forensic Science:

THE PRINCIPLE OF EXCHANGE – contd.

Happens during the contact established at the crime scene

Examples:

Blood of victim → transfer to → suspect's shirt

Tire mark → transfer to → road surface

A fallout of Exchange Principle is the 'Principle of Identification'

2. THE PRINCIPLE OF IDENTIFICATION

Definition: Identification of a substance establishes the physical, chemical, or biological identity of that substance **with the most certainty that existing analytical techniques will permit** (Saferstein, 2019).

A substance is identified following protocols that prescribe characteristics that are distinctive or *unique* for that **class of substance** (Jayaprakash, 2013; 2023) thereby excluding the items belonging to other classes.

EXAMPLES OF IDENTIFICATION

Examples include:

i. .22 is the caliber that is uniquely *measurable* for a class of rifled firearms.

ii. Ganja (marijuana) has the combination of the *morphologically* unique cystolithic hairs and the chemical characteristics of THC (tetrahydrocannabinol).

iii. Tread pattern in a class of tire with unique for that class of tires.

iv. Paired nasal bone that is unique for the class of human skulls among primates.

THE PRINCIPLE OF IDENTIFICATION – contd.

Transferred trace evidence recognized at the crime scene as physical evidence are sent to the laboratory – and then their nature – physical, chemical or biological - confirmed in the laboratory

Examples:

Blood of victim → transfer to → suspect's shirt → Human blood Blood group

Tire mark → transfer to → road surface → Tire size Tread pattern

Evidence assigned to 'class' – based on unique features of that class

A fallout of Identification Principle is the 'Principle of Individualization'

3. THE PRINCIPLE OF INDIVIDUALIZATION

Recognized at the crime scene in the physical evidence – and then confirmed in the laboratory

Definition: Individualization is a process by which the **examiner concludes** a specific source of origin of an evidence based on the relationship between the **visually observable features** in the patterns which is considered unique to the *evidence* and s*ource* object (Evett and Williams, 1996).

Uniqueness forms the basis for the random and indeterministic features which enable comparison and source attribution (Jayaprakash, 2013).

EXAMPLES OF INDIVIDUALIZATION

Examples include:

i. Patterns in one of the torn edges in paper or metal sheet exhibiting complementariness that match with the patterns in the other torn edge.

ii. Striation marks on a bullet from a SOC matching with the striation marks from a bullet fired from the suspected firearm.

iii. Wear patterns in a footwear print matching with the patterns in suspect shoe.

iv. X-ray patterns of bone morphology e.g suture patterns recorded from a recovered skull matching with similar patterns in antemortem X-ray.

THE PRINCIPLE OF INDIVDUALIZATION – contd.

Evidence assigned to specific or single source

<u>Uniqueness</u> forms the basis for any individualization

Examples:

Blood of victim → transfer to → suspect's shirt → Human blood Blood group → DNA profile

Tire mark → transfer to → road surface → Tire size Tread pattern → Wear pattern

Evidence assigned to one source 'individualization' – based on unique features specific for that source object

Every 'identification' and 'individualization' lead to 'reconstruction' principle

4. THE PRINCIPLE OF RECONSTRUCTION

a) Collectable physical evidence recognized in the crime scene

Enable reconstruction of specific events

b) Observable evidence recognized in crime scenes

Enable reconstruction of dynamic events

Observable evidence based reconstruction of dynamic events enables more effective in arriving at the manner of death in equivocal death investigations

4. THE PRINCIPLE OF RECONSTRUCTION

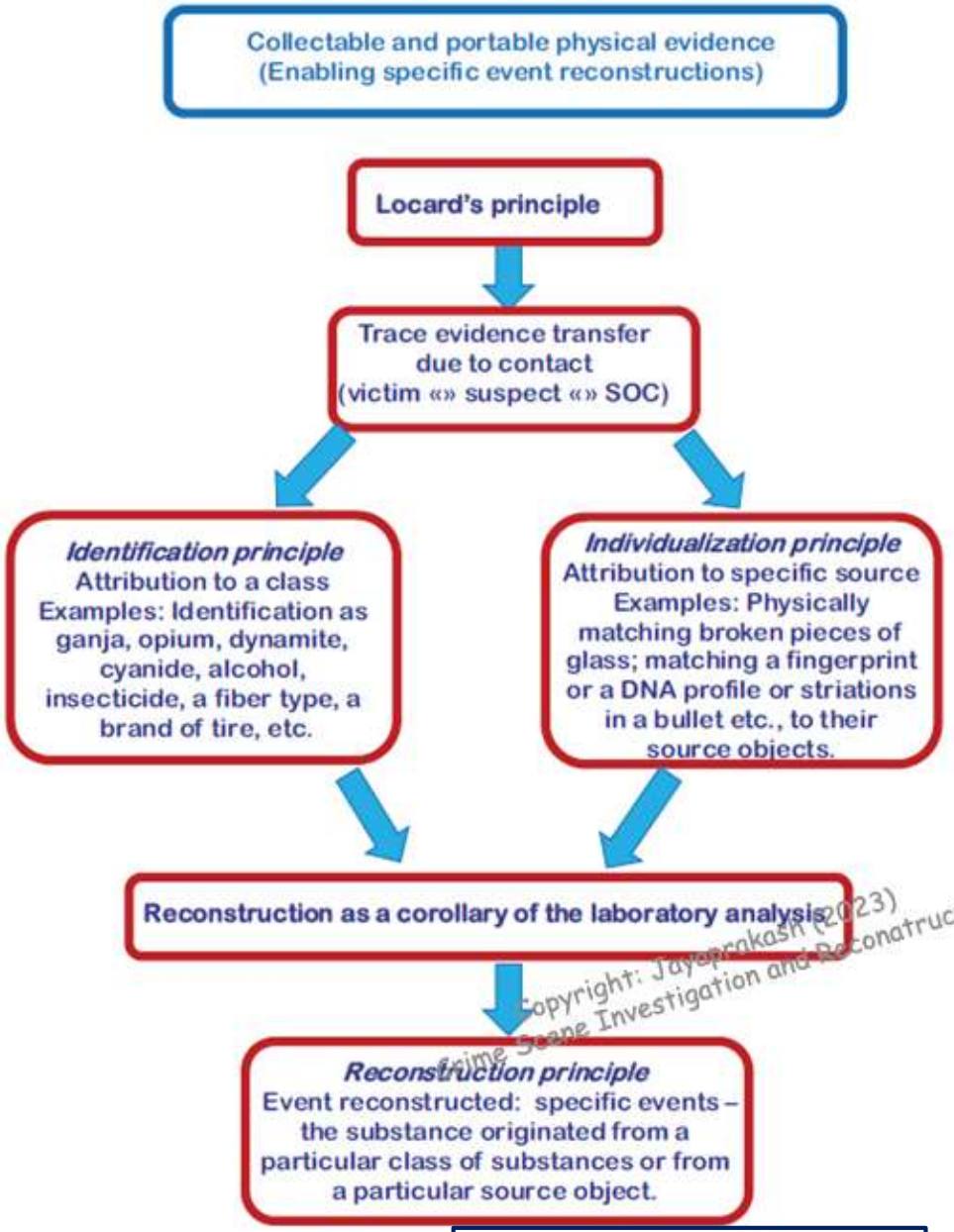
Collectable physical evidence recognized in the crime scene

Corresponding known samples from suspect

Both are sent to the Forensic Science Laboratory for comparative analysis

Association established by laboratory report

Specific event relating to the transfer of evidence as a corollary to the analytical report



Source: Jayaprakash, 2023

Traditional method of crime scene reconstruction:

Reconstruction is as an offshoot of 'association' established during physical evidence analysis (Inman and Rudin, 2001; Saferstein, 2019).

Relies on collectable evidence

Disadvantages:

1. Delayed until the receipt of report from laboratory
2. Cannot be useful for guiding the investigation
3. Generates **specific event** reconstructions

4. THE PRINCIPLE OF RECONSTRUCTION

b) Observable evidence based

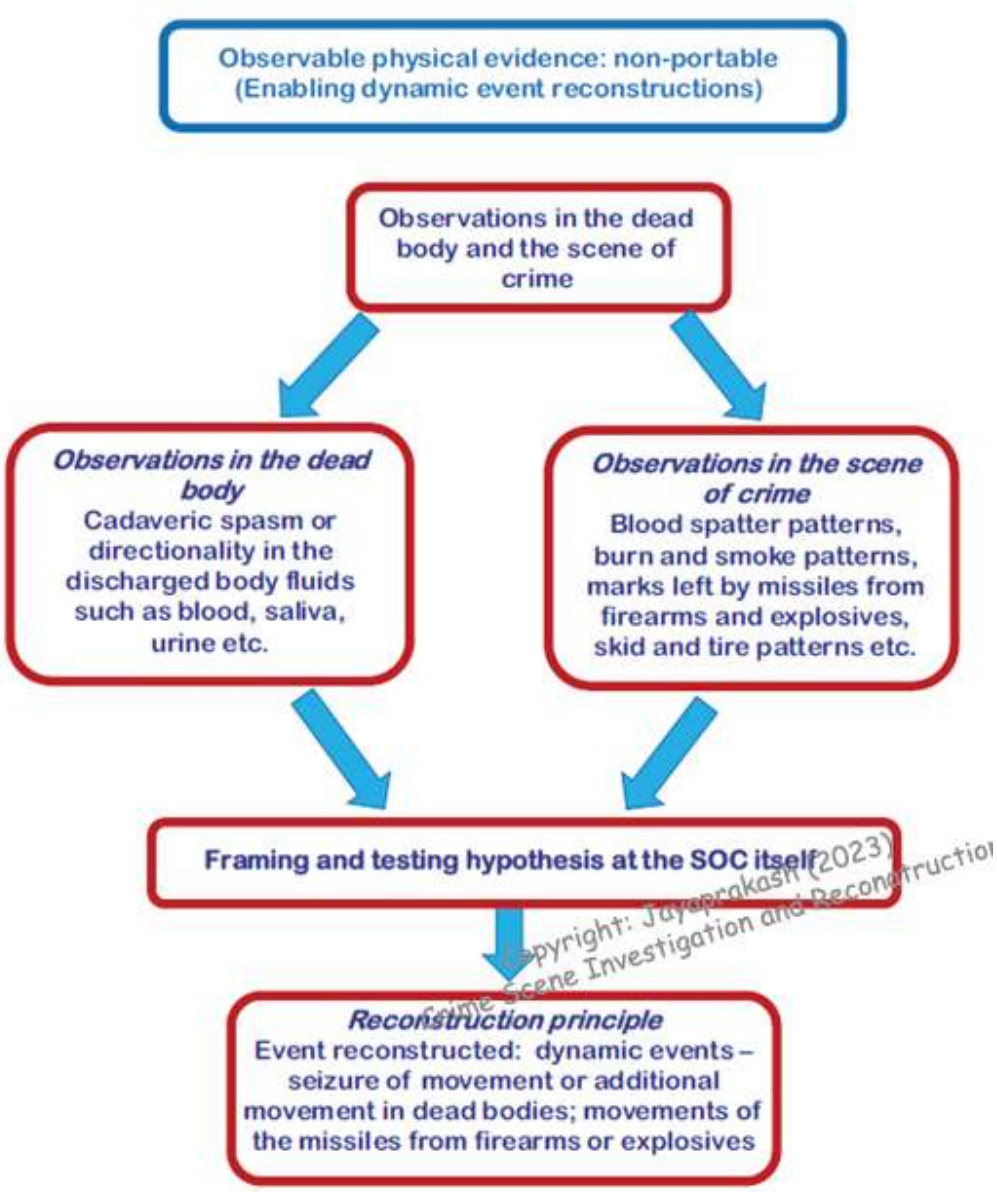
Observations are facts - can be photographed and recorded

In this method, a hypothesis based on an **observation in the SOC is tested against premises** which are known for arriving at a reconstruction.

Advantages:

1. Generates dynamic event reconstructions
2. Can be useful for guiding the investigation
3. Made immediately in the crime scene itself

Guides investigation in the SOC itself



Basis: *Observe-hypothesize* model

Source: Jayaprakash, 2023

THE *OBSERVE–HYPOTHESIZE* MODEL (Jayaprakash, 2023)

- Observations are '*facts*' that are obvious and eloquent.
- Crime scene 'observations' useful for crime reconstruction are *qualitative* and do not require measurements, equations, or statistics.
- Being qualitative observations are demonstrative.

- During hypothesis testing, the observable facts are tested for acceptance using facts that have gained prior acceptance (inductive basis).
- In every case, the hypothesis must be multiple - such as one *primary hypothesis* and another *alternative hypothesis*.

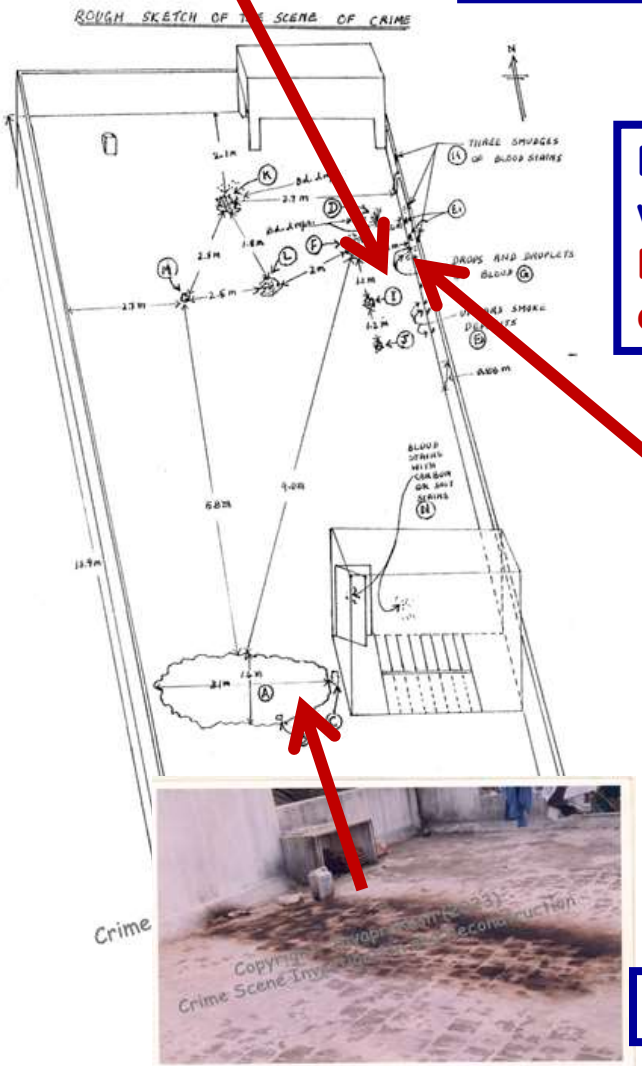
- *Sequential hypotheses* are those proposed for the sequence or multiples of observed facts in the same-case scenario.
- Hypotheses are supported and not proved.
- When multiples of sequential-hypotheses are supported, one is led to arrive at *strong inference* (Platt, 1964) that one of the major hypotheses (among *primary* and *alternative*) is *excluded,* and the other remains *supported*.

‘Collectable’ vs ‘Observable’ Evidence–specific & dynamic event reconstruction

Final location of the dead burn victim with bleeding fingers - 9.8m away from the initial location.
Blood: Collectable evidence

Blood group analysis in lab. Similar group

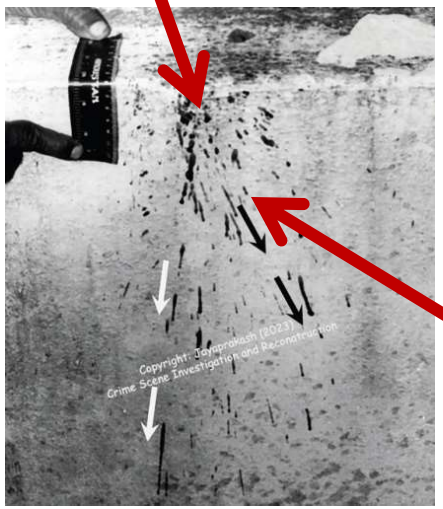
Corollary to laboratory analysis: Association between transferred evidence



Bloodstains on parapet wall
Blood: Collectable evidence

Reconstruction – specific event –BLOOD TRANSFER

Analytical report does not provide information on movement or actions of the victim or the manner of death



Observable evidence in the same SOC: Cast-off bloodstain patterns

Initial location of burning

Source: Jayaprakash, 2023

‘Observable’ Evidence–leading to dynamic event reconstruction

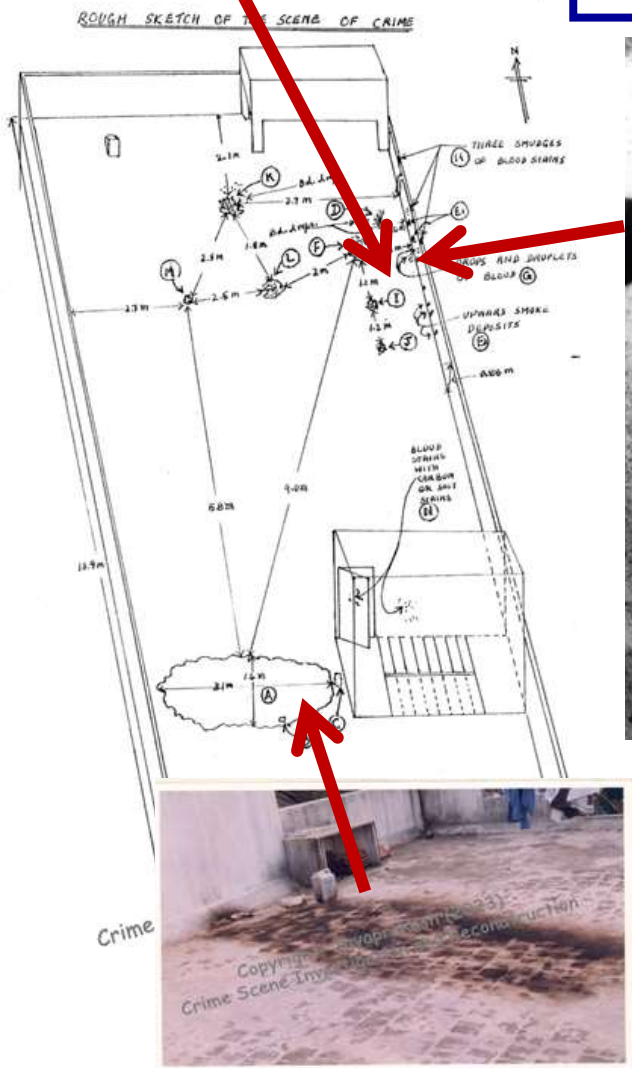
Collectable evidence-
Blood group analysis

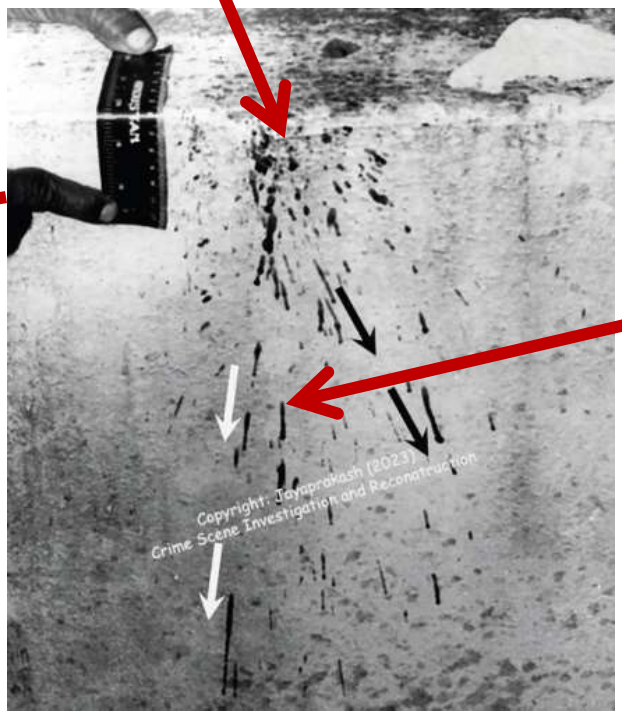
Similar group

Laboratory analysis Association

Collectable evidence
Blood group analysis

Reconstruction – specific event –blood transfer





ACTIONS OF VICTIM – NOT INFERABLE

Observable evidence
Cast-off bloodstain patterns – more than one direction

Cause and effect:
Effect: Cast-off patterns
Cause: Swinging action - multiple

RECONSTRUCTION
Dynamic event - Victim was actively moving her hands while burning – Strong inference

Manner of death supported: Suicide

Initial location of burning

Source: Jayaprakash, 2023

Message:

- Locard's Principle accounts for the transfer of physical evidence.
- Traditionally, forensic science laboratories have been analyzing transferred traces as 'physical evidence'.
- This tradition has downsized crime reconstruction to remain an off-shoot of laboratory analysis.
- Laboratory analyses of *collectable* physical clues enable reconstruction; but, the investigator has to wait for the analytical report – **does not guide the investigation**.
- ***Observable* physical evidence**, that are recognized in crime scenes enable reconstructing events in the crime scene itself – **can guide the investigation**.
- **There is a need for a paradigm shift to always include 'observable evidence' and to arrive at reconstructions that can inform on the movement of the victim or suspect in a crime scene**
- Here the golden rule is, as stated by Sir Arthur Canon Doyle in *The Sign of the Four*, **"when you have eliminated the impossible, whatever remains, *however improbable*, must be the truth?"** (Doyle, 1908).

DNA Profiling

- Evidentiary value
- Emerging technologies in DNA Profiling

- DNA is an abbreviation for **deoxyribonucleic acid**.
- It carries the **coded information** that makes every person an **individual**.
- This code is **inherited from a person's parents** so it can also be used to prove **biological family ties**.

Uses of DNA profiling - This technique proves useful in

(i) **establishing paternity** for fathers attempting to avoid supporting their illegitimate children by denying paternity and
(ii) utilizing a **blood or semen stain found at the scene of crime** – even if it is minute in size and of considerable age- for comparing with the DNA profile derived from a suspect or suspects.
(iii) Utilizing **portions of body samples from unidentified dead** bodies and relating the DNA profile with those of parents/relatives when such people are available. Preferable samples are bone marrow or teeth.

The importance of the technique lies in its **certainty- either the profiles match and the suspect is guilty, or they do not and he can be eliminated from the police inquiry**.

Possible samples analyzable for DNA

- Liquid blood samples
- Bloodstains
- Body fluid stains
- Seminal stains and vaginal stains
- Saliva and salivary stains
- Soft tissue or bone marrow
- Hairs
- Dry bones
- Teeth
- Envelope flaps or stamps
- Cigarette butts

Two sources of DNA in cells

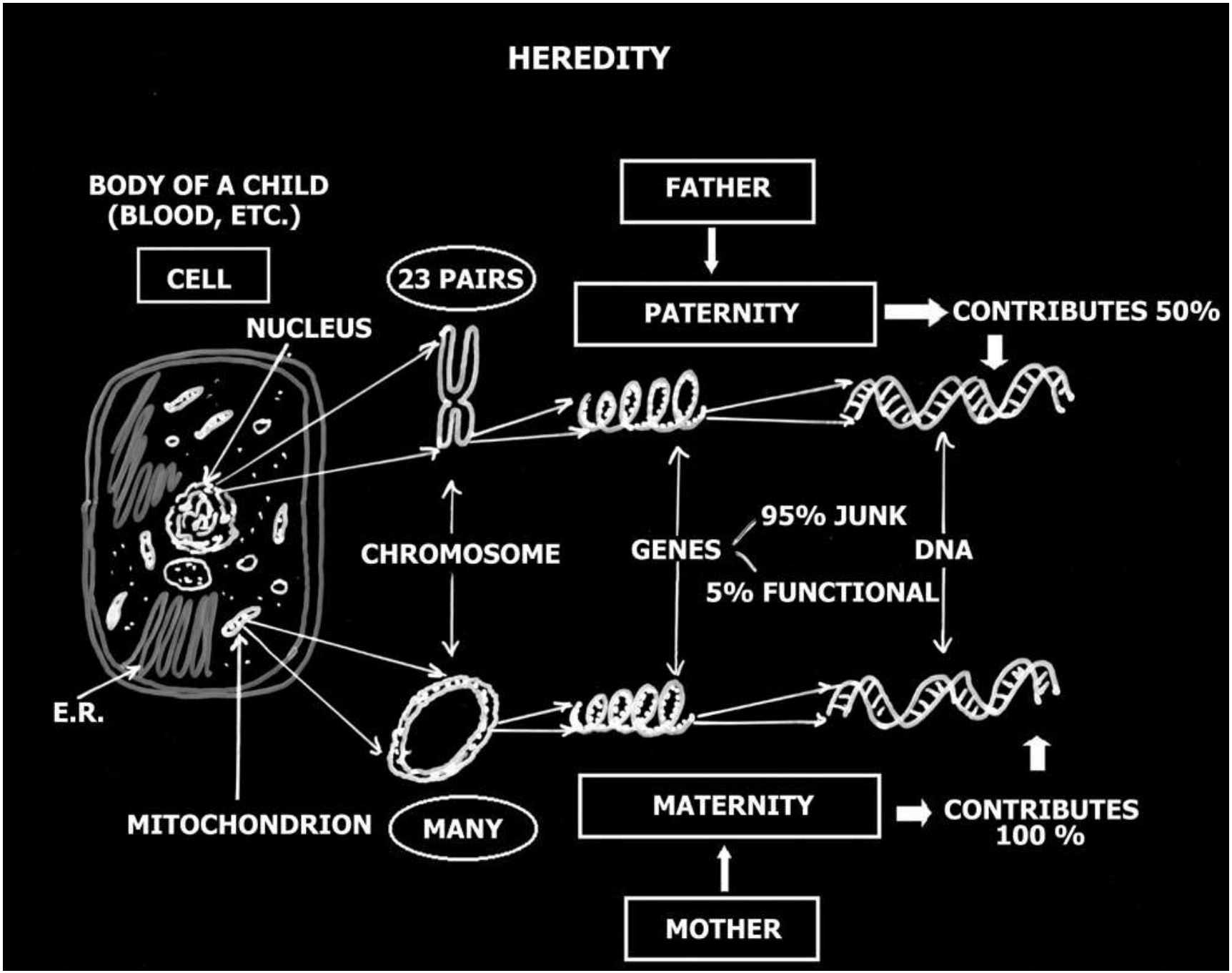
NUCLEAR DNA is a product of the DNA from a person's mother and father.

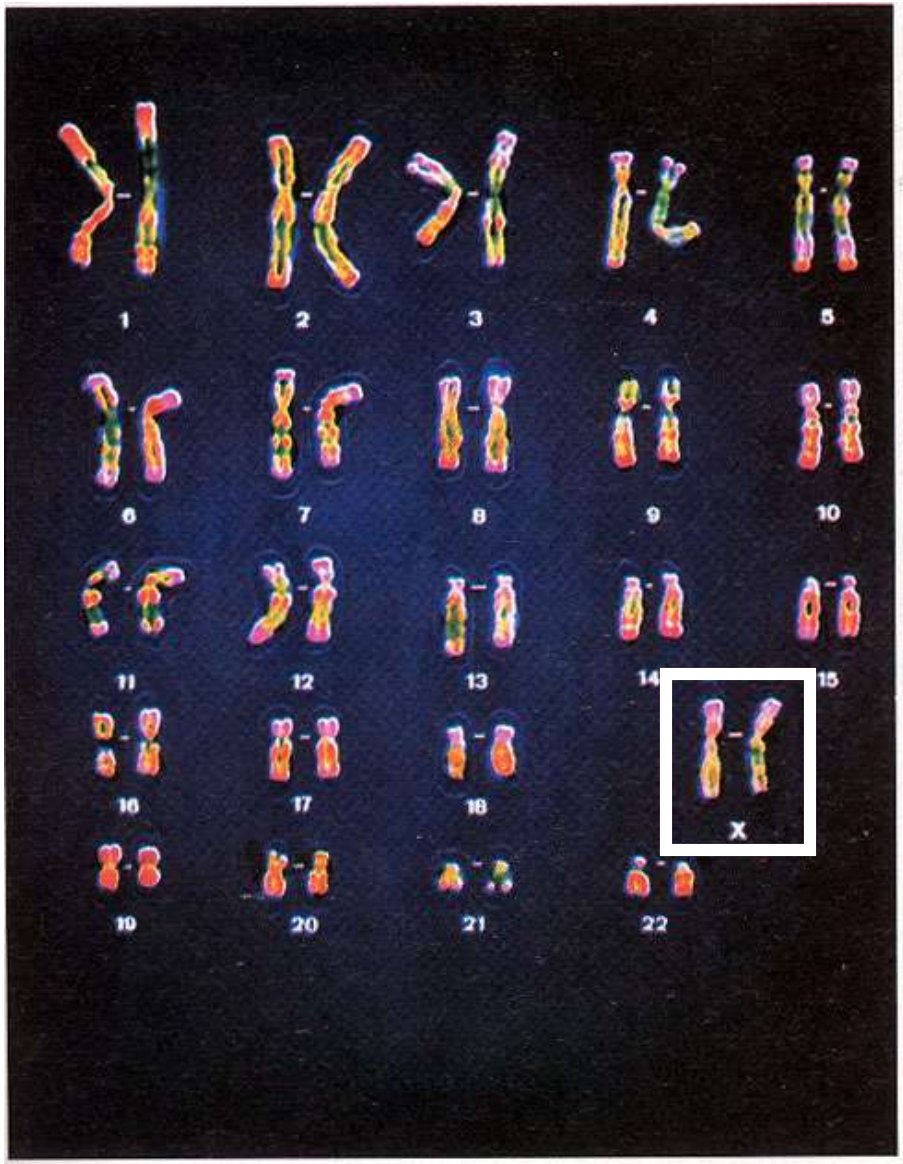
When a sperm and egg join at conception the new individual gets half of its nuclear genetic information, 23 chromosomes, from each parent.

MITOCHONDRIAL DNA is inherited only from the mother.

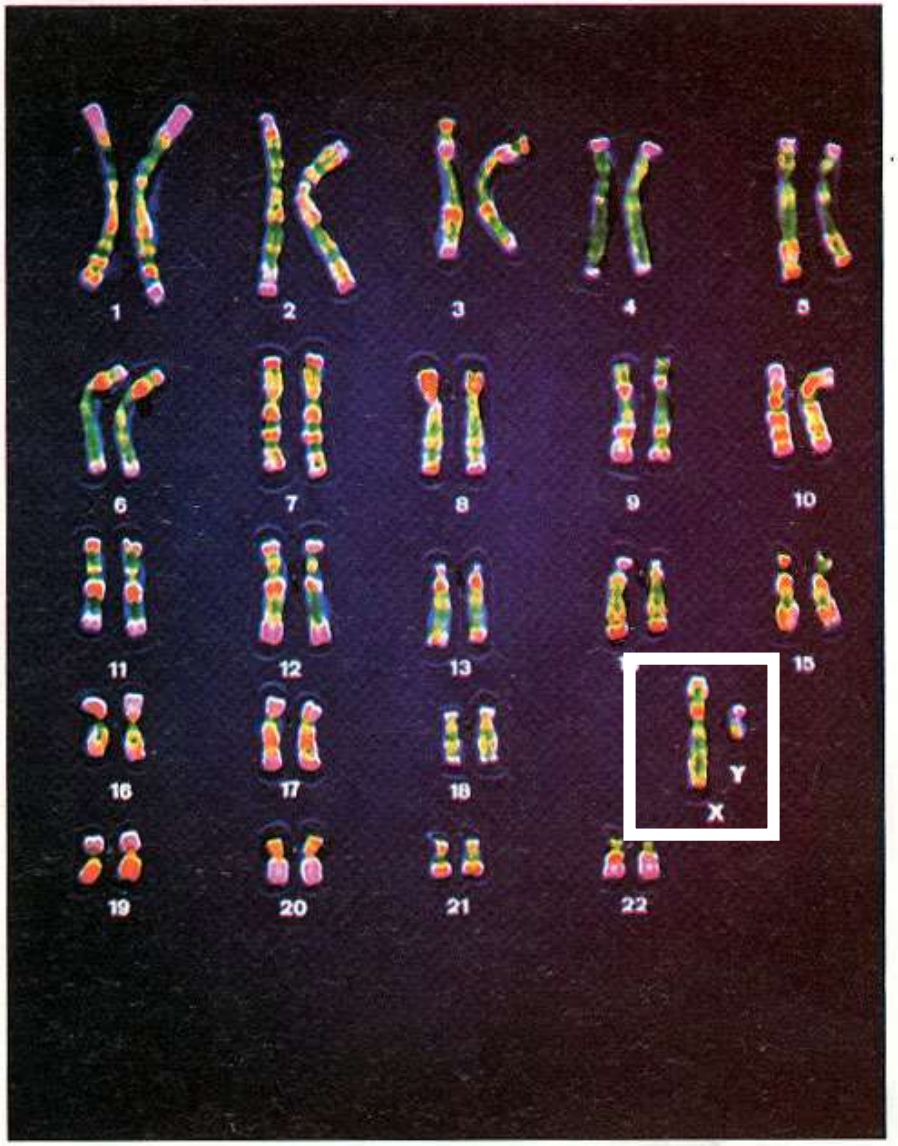
At conception all of a new person's mitochondria come from the mother.

Since mitochondrial DNA (mt DNA) is passed directly from grandmother to mother to child it serves as a perfect identity marker for maternal relatives.


HEREDITY
BODY OF A CHILD
(BLOOD, ETC.)
CELL
NUCLEUS
23 PAIRS
FATHER
PATERNITY
CONTRIBUTES 50%
CHROMOSOME
GENES
95% JUNK
5% FUNCTIONAL
DNA
E.R.
MITOCHONDRION
MANY
MATERNITY
CONTRIBUTES
100 %
MOTHER



(a)



(b)

Figure 4.3 False-color micrographs showing the chromosomes of (a) a woman and (b) a man. The chromosomes were prepared with the normal trypsin/leishman banding technique; X and Y chromosomes as well as the autosomes can be identified by this technique. (CNRI/Science Photo Library/Photo Researchers.)

- DNA is made up of four chemicals, called bases, which are like teeth in a zipper and arranged in a spiral called a double helix.

The four chemicals called bases, A,T, G and C (Adenine, Thiamine, Guanine and Cytosine), are arranged in pairs.

- A and T bind together. G and C bind together. DNA is composed of millions of these bases and their combinations are unique to each person - exception 'identical twins'.

GCA TTG CGT ACA ATT GCT ACC TTG ATC CGA TAT

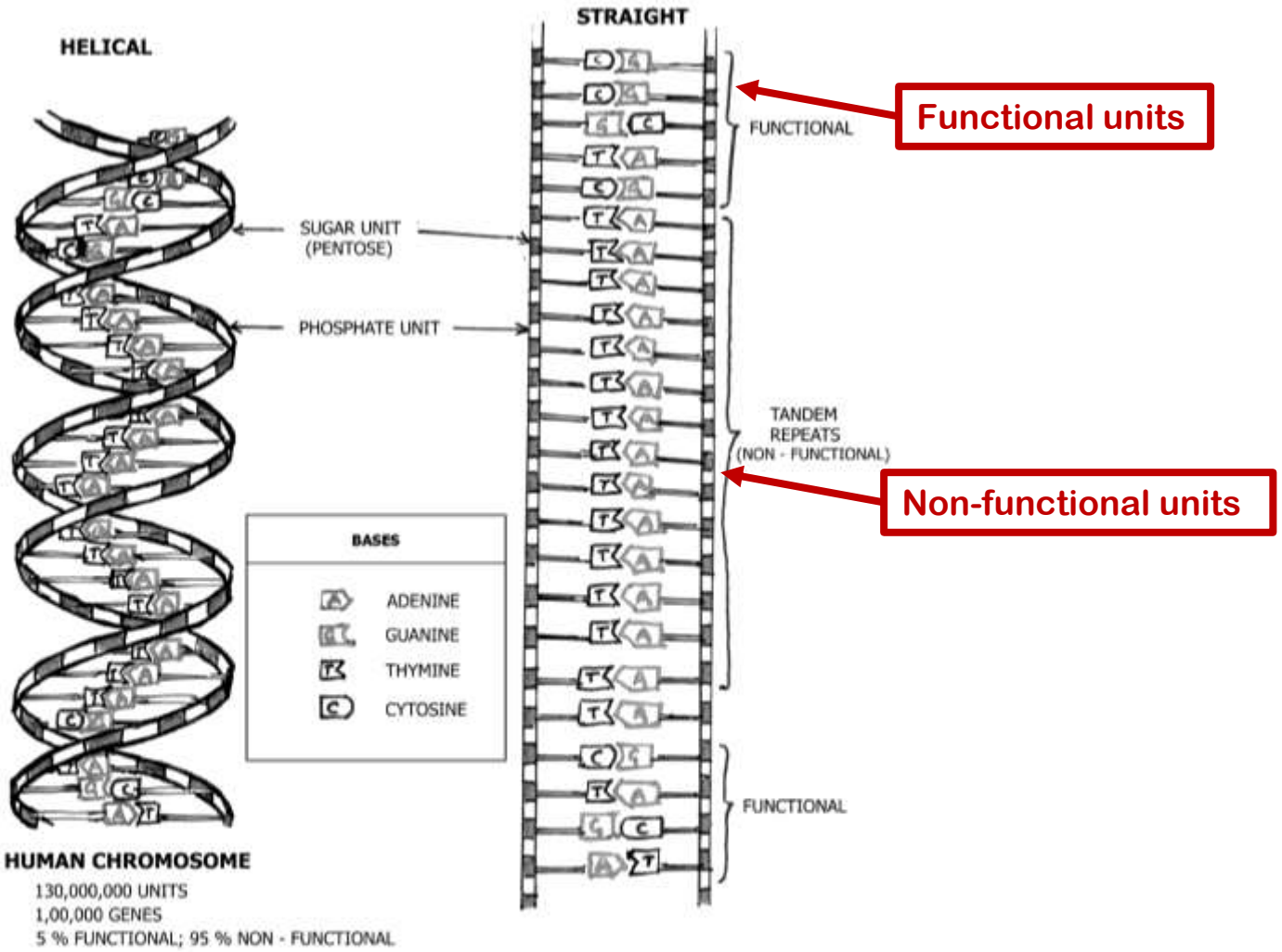
I I I II I I II I II III III III III II I III I III

CGT AAC GCA TGT TAA CGA TGG AAC TAG GCT ATA

GENE: A SPECIFIC SEQUENCE OF A, T, C AND G BASES ON A STRAND OF DNA IS KNOWN AS GENE

Such specific sequence can be functional or non-functional

Non-functional gene units are used during DNA profiling



PROF.ALEC JEFFREYS - 1985 - DNA FINGER PRINTING

PCR: - POLYMERASE CHAIN REACTION

- EVEN SMALL QUANTITY IS SUFFICIENT
- Eg: HAIRS, BLOOD DROPS, SEMEN STAINS, TISSUE TRACES ETC.,
- TANDEM REPEATS VARY IN INDIVIDUALS
- THEY ARE RADIOACTIVELY LABELLED AND DETECTED

Nuclear DNA	Mitochondrial DNA
Found only in the cell nucleus	Found only in the mitochondria which is in the cell body but outside the nucleus
The cell nucleus is the cell's control center-nuclear DNA contains a person's inherited triats such as eye color, height etc.	Mitrochondria are the cell's energy- producing power plants-mitochondrial DNA is the mitochondria's hereditary material
One group per cell	Many groups per cell
Half (23) from mother and half (23) from father	All from mother and identical to mother's mitochondrial DNA
Used to prove kin with father or mother	Used to prove kin with maternal relatives (identical)

LANDMARK DISCOVERIES

WATSON
CRICK
WILKINS
} 1953 → DOUBLE HELIX DISCOVERY DNA STRUCTURE

PROF.ALEC JEFFREYS 1985 → DNA FINGERPRINTING

KARY MULLIS 1993 → POLYMERASE CHAIN REACTION

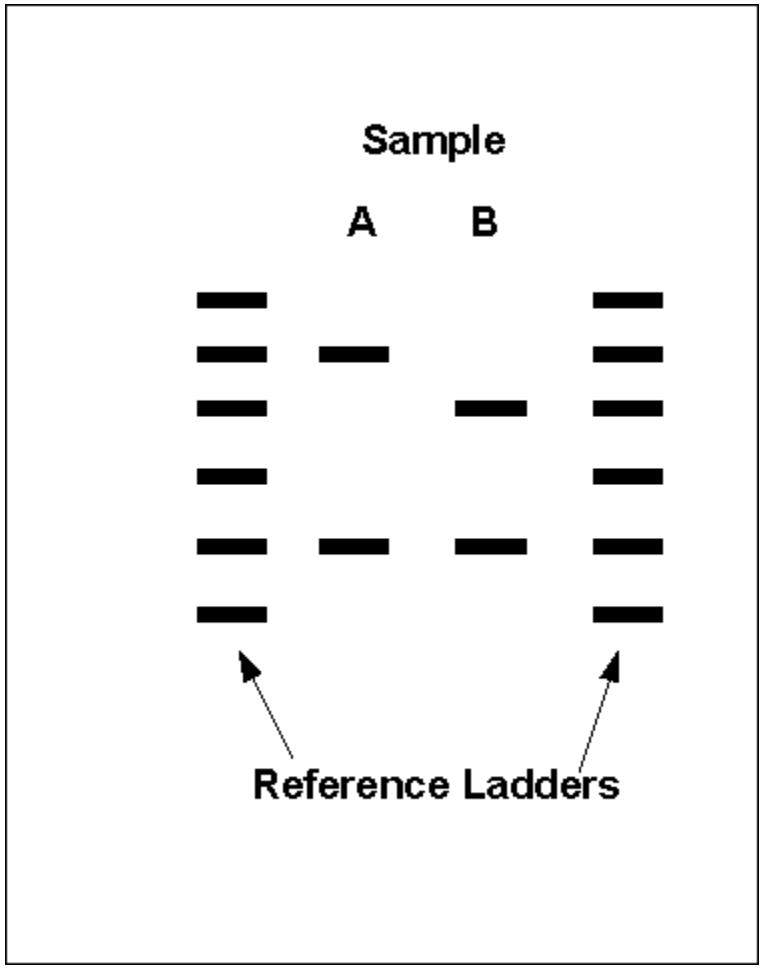
REGULAR FINGERPRINTING	VS.	DNA FINGERPRINTING
↓		↓
COMPLETE (100 % unique)		PARTIAL (1% to 0.1% unique)
↓		↓
TWINS DIFFER		TWINS ARE ALIKE

DNA PROFILING AND POLYMERASE CHAIN REACTION (PCR)

- 1. DNA profiling is most important discovery in the recent scientific history of forensics.
- 2. Polymerase chain reaction (PCR) enables multiplying DNA from traces recovered in crime scenes.
- These two techniques when carried out together have proven to be the strongest biological evidence.

Discovery of DNA 'fingerprinting'

- It was in 1984 that Professor Alec Jeffreys, a Research Fellow at the Lister Institute, Leicester University, achieved the breakthrough that made DNA a practical tool to identify positively any individual from the minutest body trace.
- Professor Jeffreys discovered that within the DNA molecule a particular sequence of information exists which varies greatly in unrelated individuals.
- These sequences can be "visualized" in the laboratory as prints from X-ray film which are as unique to an individual as a conventional fingerprint- hence the colloquial term 'DNA fingerprinting'.


Sample
A
B
Reference Ladders

THE POLYMERASE CHAIN REACTION (PCR)

- PCR invention - dramatic impact on the use of DNA in forensic analysis
- Uses an enzyme called DNA polymerase
- PCR results in the amplification (increasing the number of units) of a specific DNA fragment such that it can be visualized
- Procedure takes only a few hours
- Requires only a small amount of DNA as starting material

- **DNA Profiling: Evidentiary value**
  - **Evidentiary value – the most powerful biological tool in forensic science**
  - **The revolutionary use of Short Tandem Repeats**
  - **Product rule based interpretation of probability for paternity – one in trillion**

EMERGENCE OF SHORT TANDEM REPEAT (STR) ANALYSIS

- There are portions of the DNA molecule containing sequences of letters that are repeated numerous times.
- In fact, more than 30 percent of the human genome is composed of repeating segments of DNA.
- These repeating sequences, or *tandem repeats*, seem to act as filler or spacers between the coding regions of DNA.
- The origin of Short Tandem repeats (STRs) and their significance is a mystery, but to forensic scientists they offer a means of distinguishing one individual from another through DNA typing.
- Currently, **short tandem repeat (STR)** analysis has emerged as the most successful and widely used DNA-profiling procedure.
- Because of their shortness, STRs are an ideal candidate for multiplication by PCR, thus overcoming the limited-sample size problem often associated with crime-scene evidence such as saliva residue on envelopes, stamps, soda cans, and cigarette butts (Saferstein, 2019).

STRs (Short Tandem Repeats) in population and the probability of identity

- The probability of identity is a measure of the likelihood that two individuals selected in a particular population at random will have an identical STR (Short Tandem Repeat) type.
- The smaller the value of this probability, the more discriminating the STR.
- A high degree of discrimination and even individualization can be attained by analyzing a combination of STRs (multiplexing).
- This combination is referred to as the *product rule*. Hence, the greater the number of STRs characterized, the smaller the frequency of occurrence of the analyzed sample in the general population.

Product rule based frequency for 13 STR combination

- The combination of the three STRs are shown to produce a frequency of occurrence of about 1 in 5,000.
- A combination of the six STRs yields a frequency of occurrence in the range of 1 in 2 million for the Caucasian population.
- The combination of all thirteen STRs has been shown to produces frequencies of occurrence that measure in the range of 1 in 575 trillion for Caucasian Americans and 1 in 900 trillion for African Americans.
- Several commercially available kits allow forensic scientists to profile STRs in the kinds of combinations cited here (Saferstein, 2019).

Significance of DNA Typing

- STR DNA typing has become an essential and basic investigative tool in the law enforcement community.
- DNA evidence is impartial, implicating the guilty and exonerating the innocent.
- In a number of well-publicized cases, DNA evidence has exonerated individuals who have been wrongly convicted and imprisoned.
- The importance of DNA analyses in criminal investigations has also placed added burdens on crime laboratories to improve their quality-assurance procedures and to ensure the correctness of their results (Saferstein, 2019).

The power of DNA profiling from traces:

- During intercourse, DNA transfer occurs when skin cells from the walls of a female victim's vagina are transferred onto the suspect.
- Subsequent penile contact with the inner surface of the suspect's underwear often leads to the recovery of the female victim's DNA from the underwear's inner surface.
- The power of DNA is illustrated by a case in which the female victim of a sexual assault had consensual sexual intercourse with a male partner before being assaulted by a different male.
- DNA extracted from the inside front area of the suspect's underwear revealed a female DNA profile matching that of the victim.
- In addition, traces of male DNA on the same underwear from the suspect matched that of the consensual partner.

(Source: Saferstein, 2019)

➢ DNA Profiling: Emerging technologies in DNA Profiling

- Use of FTA (Flinders Technology Associates) card has tremendously reduced the risk of contamination at the collection point of samples from suspects
- In countries like India they are presently using 15 STRs
- Reported advancement include the possible use of 24 strs to further increase the probability towards conclusive identity.
- However, technically, conclusive identity on par with physical matching or traditional fingerprint matching cannot be achieved using DNA profiling since the latter relies on population genetics and intpretations based on probability.

ON THE BEST PRACTICES DURING COLLECTION OF DNA BEARING EVIDENCE FROM CRIME SCENE EXAMINATION

Disturbances leading to physical evidence contamination:
Follow the standard operating procedures for contamination prevention (Saferstein, 2019).

Always use **latex gloves** and/or disposable forceps for collecting evidence requiring DNA analysis, and make sure to change the gloves for each evidence.

Clean and sanitize all equipment that are not disposable before and after visiting a crime scene and between collecting each piece of evidence.

Any DNA bearing biological stain identified as useful in the SOC should be, for purposes of transparency and authentication, first described indicating the **stain pattern, and should photographed** before collection.

Account for surmising the presence of biological stains that are not readily visible such as **saliva or semen** before preserving the physical evidence/swab for DNA analysis – describe the presence of a bite mark prior to collecting a swab of saliva.

Attempting DNA analysis on evidence items that **do not reveal any cue to infer the presence of body fluid traces**, apart from lacking scientific basis, is likely to breed inimical speculations on contamination e.g. Kercher case.

Kercher case acquired notoriety mainly due to the generation of DNA profiles matching that of a suspect from a knife which was recovered 46 days after the discovery of the crime and on which there was no blood (Hogenboom, 2014; Balk, 2015).

DNA profile linking the suspect was also generated from a bra clasp that remained in the scene for 47 days since occurrence.

In addition, there already was another suspect whose DNA was found in biological stains which were more copiously deposited in the scene and who also chose to plead guilty.

Investigation officers' prerogative to include new suspects apart from finding DNA profiles matching a suspect on a knife discovered after 46 days and on which bloodstains were absent appear counterintuitive.

Explaining it as due to contamination begs the question: Was it the particular suspect's DNA alone that contaminated a knife that was recovered after 46 days of occurrence?

O. J. SIMPSON: A MOUNTAIN OF EVIDENCE – OF NO AWAIL

- The bodies of O. J. Simpson's estranged wife and her friend Ron Goldman were found on the path leading to the front door of Nicole's home.
- Both bodies were covered in blood and had received deep knife wounds.
- Nicole's head was nearly severed from her body.
- A trail of blood led away from the murder scene.

- Blood was found in O. J. Simpson's Bronco (car).

- There were blood drops on O. J.'s driveway and in the foyer of his home.

- A blood-soaked sock was located in O. J. Simpson's bedroom, and a bloodstained glove rested on the ground outside his residence (Saferstein, 2019).

- As DNA was extracted and profiled from each bloodstained article, a picture emerged that seemed to irrefutably link Simpson to the murders.
- A trail of DNA leaving the crime scene was consistent with O. J.'s profile, as was the DNA found in Simpson's home.
- Simpson's DNA profile was found in the Bronco along with that of both victims.
- The glove contained the DNA profiles of Nicole and Ron, and the sock had Nicole's DNA profile.
- At trial, the defense team valiantly fought back.
- Miscues in evidence collection – including in chain of custody - were craftily exploited.
- The defense strategy was to paint a picture of not only an incompetent investigation but one that was tinged with dishonest police planting evidence.
- The strategy worked. O. J. Simpson was acquitted of murder. (Source: Saferstein, 2019).

Common challenges before the Court

- Chain of custody
- Privacy and Ethical concerns

Chain of custody and other issues

- Common challenges before the Court
  - Lapses in chain of custody – O. J. Simpson case
  - Failure to use Common Salt as preservative for tissues etc. – Sending samples in plastic cover or vials without preservative leads to decomposition – need to take advice from Scene of Crime Officers) SOCO
  - Laboratories usually repeat analysis until obtaining positive result
  - Failure to send the sample seal when forwarding the items to the laboratory
  - Habit of using the same soft copy for all cases leads to issues due to careless cut and paste activities. At times the gender is filled in wrongly following the older soft copy
  - Prescribing impractical time frame for analysis in sensational case types - POCSO Cases in India – Practical constraint in laboratory is that cases flow from a larger geographical area leading to backlog.

Privacy and Ethical concerns

Quality considerations

- In a research, most of the participants acknowledged the importance of performing DNA paternity testing in accredited laboratories.
- Concordant with earlier findings, most important considerations for participants were the « accuracy », « validity » and « confidentiality » of the test itself.
- There is a need for establishing a legal frame work to create a flexible environment that is conductive to genomic/genetic research and DNA paternity testing.

Consent and privacy:

- Findings should be preferably released to the concerned person or to individuals for whom the test recipient has given consent.
- The method of communication should be chosen in advance to preserve genetic privacy and minimize the likelihood that results will be shared with unauthorized persons or organizations.
- The misuse of genetic information is an issue often reported because it may lead to discrimination, stigmatization, dignitary concerns, psychological harm and family disruption, particularly in countries where cultures differ widely in their traditions of gender roles, marriage, parenthood, and family life.
- The presence of a psychologist while communicating results is desired since the test may reveal sensitive information that can damage relationships and cause serious harm to beneficiaries, especially children.

Incidental findings disclosure:

- Interestingly, a significantly higher percentage of men respondents wished to be informed about misattributed paternity as compared to women.
- This trend can be attributed to the fact that women are probably afraid of getting violated or murdered in the name of so-called ‘‘honour’’ if misattributed paternity was proved.
- Indeed, in countries where women are subject to discrimination and often lack social power, misattributed paternity can have serious social repercussions such as social stigma, divorce, or physical violence, thus emphasizing the importance of referring to a judge for disclosure incidental findings.
- The gender difference evident in one research is important since it may help in the way of reporting misattributed paternity among the population, and highlights the necessity of creating legislative framework dealing with genetic explorations in the context of DNA paternity testing.

Refences for further reading:

Jayaprakash, P. T. *Crime Scene Investigation and Reconstruction: An Illustrated Manual and Field Guide*, Boca Raton, London, CRC Press, Taylor & Francis, 2023.

Saferstein, R. *Forensic Science: From the Crime Scene to the Crime Lab*, 4th Ed. New York: Pearson Education, 2019.

Azoury et al., Perception of the general public towards the ethical and legal issues surrounding DNA paternity testing in Lebanon, https://doi.org/10.1016/j.jemep.2021.100640 2352-5525/© 2021 Elsevier Masson SAS.

predispositions to diseases, ancestral origins, and familial relationships. Unauthorized disclosure of this information can have serious privacy implications.

2. **Familial Privacy:** When one person undergoes DNA testing, it can inadvertently expose genetic information about relatives who did not consent to the test. This can raise ethical concerns about the right to privacy of family members.
3. **Data Security Concerns:** DNA data needs to be stored and handled securely to prevent unauthorized access or hacking. Breaches in security could lead to the misuse of sensitive genetic information.
4. **Third-Party Access:** There's a risk that DNA testing companies or other entities might share or sell genetic data to third parties for research, commercial, or other purposes without the explicit consent of the individuals

Interplay between biological truth (DNA evidence) and legal presumptions

- One of the challenging cases involving presumption of DNA and legitimacy in evidence is the case of *Michael H. v. Gerald D.* in the United States Supreme Court.

- In this case, the presumption of legitimacy clashed with DNA evidence. The facts involved a child born to a married woman (Melissa) but conceived during an extramarital affair with another man (Michael H.). Melissa's husband (Gerald D.) was listed as the child's father on the birth certificate. Michael H. sought to establish paternity based on DNA evidence.

- The California law at that time established a presumption of legitimacy for children born to married couples, stating that a child born during a marriage is presumed to be the legitimate child of the husband.

- Michael H. filed a lawsuit seeking to establish paternity, presenting DNA evidence that conclusively proved he was the biological father of the child. However, this conflicted with the presumption of legitimacy under California law.

- The Supreme Court was faced with reconciling the presumption of legitimacy with the biological evidence presented through DNA testing. The decision revolved around whether the biological truth (established through DNA evidence) should supersede the presumption of legitimacy.

- Ultimately, the Supreme Court ruled in favor of upholding the presumption of legitimacy. They argued that the interests of the child and the stability of the family outweighed the biological connection established by DNA evidence. The court maintained that California's presumption of legitimacy for children born into a marriage was constitutional, even when contrary DNA evidence existed.

Goutam Kundu vs. State of West Bengal

- In India, the case of Goutam Kundu vs. State of West Bengal is significant in addressing issues related to paternity, DNA evidence, and the presumption of legitimacy.
- In this case, the Supreme Court of India dealt with a situation where a married woman had a child, but the husband denied paternity. **The woman claimed that the child was born out of wedlock from an extramarital affair**. The husband sought a paternity test to establish whether he was the biological father.
- The court allowed the paternity test based on DNA evidence to determine the biological father of the child. The judgment emphasized the importance of scientific evidence (DNA) in establishing paternity and parental responsibility.
- Regarding the presumption of legitimacy, the court recognized that while there is a presumption of legitimacy for children born during a valid marriage, this presumption can be rebutted by conclusive evidence to the contrary, such as DNA test results.
- **The court underscored the significance of the best interests of the child and the right to know one's biological parentage. It highlighted that the paramount consideration should be the welfare of the child rather than strict adherence to the presumption of legitimacy.**
- As for cases in other countries, several jurisdictions have faced similar conflicts between the presumption of legitimacy and DNA evidence establishing biological paternity. For instance, in the United Kingdom, the case of Gillick v. Wisbech highlighted the courts' willingness to consider DNA evidence to rebut the presumption of legitimacy, especially when it's in the best interests of the child.
- These cases collectively demonstrate the evolving approach of courts worldwide in balancing legal presumptions, scientific evidence (such as DNA tests), and the welfare of the child when dealing with issues of paternity and legitimacy.

Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik-AIR 2014 SC 932

- The Supreme Court in Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik, AIR 2014 SC 932, observed that Section 112 of the Evidence Act was enacted at a time when the modern scientific advancement and DNA test were not even in contemplation of the Legislature.
- The result of DNA test is said to be scientifically accurate.
- Although section 112 raises a presumption of conclusive proof on satisfaction of the conditions enumerated therein but the same is rebuttable.
- Where there is evidence to the contrary, the presumption is rebuttable and must yield to proof. Interest of justice is best served by ascertaining the truth and the court should be furnished with the best available science and **may not be left to bank upon presumptions**, **unless science has no answer to the facts in issue**.
- Section 112 of the Evidence Act does not create a legal fiction but provides for presumption. The presumption under the section not only arises where the question of legitimacy is raised for the purposes of inheritance by succession but also for maintenance application under Section 125, Cr.P.C, 197

THANK YOU

ANY QUESTIONS PLEASE…