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FORENSIS

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**Exhume The Truth
&
Serve Humanity**

***REVEALING THE SECRETS
HIDDEN BENEATH THE
SURFACE.***



**THE VITAL
ROLE OF
FORENSIC
MEDICINE IN
UNCOVERING
MYSTERIES**

"Forensic science is the unravelling of criminal mysteries; where each trace of evidence whispers secrets, and every clue holds the power to reveal the truth hidden within the labyrinth of crime."

“Where the dead speaks, truth is uncovered;
Every bone tells a story, Forensic Medicine reads between the lines.”

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National Forensic Medicine Day

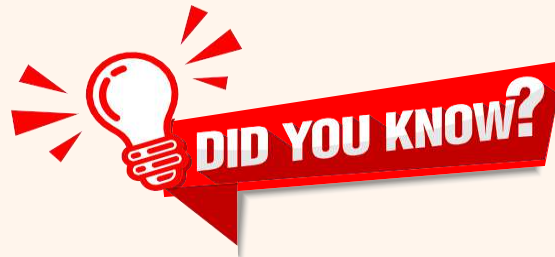
- On 12th May, National Forensic Medicine Day is observed to honor the contributions of Forensic Medicine to society. Forensic Medicine, also known as forensic pathology or legal medicine, is a branch of medicine that deals with the application of medical knowledge to the investigation of crime, particularly in cases involving injury or death. This field plays a crucial role in criminal investigations, providing expertise in determining causes of death, identifying victims, analyzing evidence, and assisting in legal proceedings.
- The day is celebrated to raise awareness about the importance of Forensic Medicine in the criminal justice system and to recognize the work of forensic pathologists, medical examiners, forensic scientists, and other professionals involved in this field. It also serves as an opportunity to highlight advancements in forensic techniques and technologies that aid in solving crimes and delivering justice.

❖ Why is National Forensic Medicine Day Celebrated?

- ❖ **Crime Investigation:** Forensic Medicine plays a critical role in crime investigation by providing scientific analysis of evidence such as bodily fluids, DNA, fingerprints, and other physical evidence. This helps law enforcement agencies in identifying suspects, linking crimes, and presenting evidence in court.
 - I. **Cause of Death Determination:** Forensic pathologists conduct autopsies to determine the cause and manner of death in cases of suspicious or unnatural deaths. This information is crucial for criminal investigations & insurance claims,.
 - II. **Legal Proceedings:** Forensic experts provide expert testimony in courts to assist judges and juries in understanding complex scientific evidence related to a case. Their expertise helps in ensuring justice is served and innocent individuals are not wrongfully convicted..
 - III. **Public Awareness:** Observing a National Forensic Medicine Day would raise awareness among the public about the importance of forensic medicine in the criminal justice system, healthcare, and society at large. It would also recognize the contributions of forensic professionals who often work behind the scenes to serve justice and uphold the law.



Key facts



According to the NCRB report, 53,874 or 36.05 percent of the 1,49,404 cases against children reported in 2023 were under the preview of the Protection of Children from Sexual Offences Act (POCSO)

The rate (incidents per 1 lakh children) for instances reported to POCSO shows a steady rise: 12.1 in 2021 (53,276 girls and 1,083 boys); 10.6 in 2021 and 2023.

According to data, the number of incidents of online fraud, online harassment, the publication of explicit content, etc. increased by 111% in 2021 (356 cases) from 168 cases in 2022.

The number of suicide deaths has risen in India by 7.2% compared to 2020, with a total of 1,64,033 death by suicide in 2023. 8% of students died by suicide. 1% of the cases were due to exam failure.

Among the Union Territories, Delhi has the highest rate of crime against women in 2023, with an increase over the past three years and UP tops in the states

According to the NCRB report, the number of crimes against women grew from 56.5% in 2020 to 64.5% in 2021, (incidents per 1 lakh population).

According to (NCRB) most recent statistics, one in four of the 1,64,033 suicide victims who died in 2021 were daily wage earners, The number of suicides at the national level increased by 7.17% from 2022 to 2023.

Economic offenses including financial fraud and property fraud saw an increase of 12.35% in 2021.

Introduction To Significance of Forensic Medicine in Exhuming The Truth



➤ *Forensic Medicine, also known as forensic pathology or forensic science, plays a crucial role in uncovering the truth in legal investigations by employing various techniques and investigations. Here's an introduction to how forensic medicine helps in exhuming the truth:*

- 1. Autopsy Examination:** One of the primary tools of forensic medicine is the autopsy, which involves a thorough examination of a deceased individual's body.
- 2. Anthropology:** Forensic anthropologists specialize in analyzing human skeletal remains to provide insights into the identity, age, sex, stature, and possible cause of death of an individual.
- 3. Toxicology Analysis:** Toxicology is the study of the effects of chemicals or substances on living organisms. Forensic toxicologists analyze bodily fluids, tissues, and organs to detect the presence of drugs, alcohol, poisons, or other toxic substances.
- 4. DNA Analysis:** DNA analysis is a powerful tool used in forensic investigations to identify individuals, establish biological relationships, and link suspects to crime scenes.
- 5. Entomology:** Forensic entomology involves the study of insects and arthropods found in or around human remains.
- 6. Ballistics Analysis:** In cases involving firearms, forensic ballistics experts analyze bullets, cartridge cases, and other firearm-related evidence to determine the type of weapon used, the direction of gunfire, and the sequence of shots fired.
- 7. Digital Forensics:** With the increasing use of technology in criminal activities, digital forensics has become essential in modern investigations.
- 8. Forensic Odontology:** Forensic odontology, or forensic dentistry, utilizes dental records and evidence from teeth to identify individuals and establish key details about their lives and deaths.
- 9. Bloodstain Pattern Analysis:** Bloodstain pattern analysis helps reconstruct events at crime scenes by examining the shapes, sizes, and distribution of bloodstains.

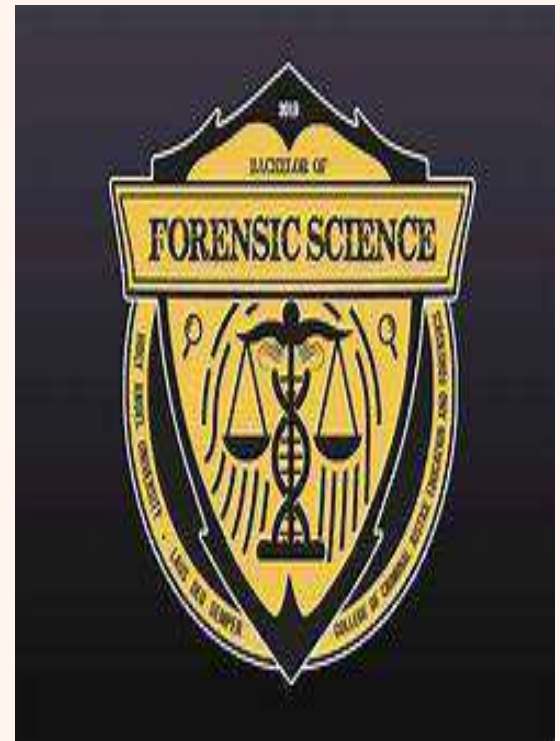


Unravelling Criminal Mysteries & Its Significance in spreading awareness in public



Overview

1. Through meticulous analysis of physical evidence, such as DNA samples, fingerprints, and ballistics, forensic experts reconstruct the sequence of events with precision.
2. By examining the minutiae of a crime scene, from blood spatter patterns to trace fibers, they piece together a narrative that speaks volumes in the language of evidence.
3. Moreover, forensic pathology plays a pivotal role in determining the cause and manner of death, providing invaluable insights into suspicious fatalities.
4. Autopsies conducted by skilled forensic pathologists unveil the physiological secrets concealed within the human body, elucidating the circumstances surrounding an individual's demise.



Spreading awareness about forensic medicine and investigations in the public is also vital for several reasons:

- A. Crime Prevention:** Public awareness of forensic methods can deter criminal behavior. Criminals may be less likely to commit crimes if they know that evidence left behind can be analyzed to identify them.
- B. Victim Advocacy:** By understanding forensic techniques, victims and their families can better grasp the investigative process and the potential for resolution.
- C. Career Awareness:** Spreading awareness about forensic science can inspire interest in related careers, like forensic pathology & DNA analysis.
- D. Policy Implications:** Public awareness can influence policies related to forensic science funding, research, and training.
- E. Educational Outreach and Engagement:** Forensic science outreach programs engage the public, particularly students and young adults, in science education and criminal justice awareness.
- F. Addressing Misconceptions and Myths:** Forensic science can debunk misconceptions and myths perpetuated by popular media about crime scene investigations, DNA analysis, and other forensic techniques.

➤ **Overall, significance of forensic medicine techniques & investigations in unsolved cases & public awareness cannot be overstated. They are essential pillars of modern law enforcement & criminal justice systems, contributing to the resolution of crimes and the prevention of future offenses**

What is Exhumation ?



- *Exhumation is the process of digging up and removing a body from its burial place, typically for further examination or investigation. In forensic medicine, exhumation serves several significant purposes:*
- A. Clarification of Cause of Death:** Sometimes, the cause of death may be unclear or suspicious.
 - B. Collection of Forensic Evidence:** In cases where new evidence emerges or advancements in forensic technology occur after burial, exhumation may be necessary to collect additional evidence.
 - C. Legal Proceedings:** Exhumation may be required for legal purposes, such as reopening an investigation or reevaluating a previous ruling.
 - D. Identification of Human Remains:** In cases involving unidentified or missing persons, exhumation may be necessary to compare DNA or dental records with those of potential matches.
 - E. Research and Training:** Exhumation also plays a role in advancing forensic science through research and training.

Purpose of Exhumation:

- 1. Medico-Legal Reasons**
- 2. Suspicion of Homicide**
- 3. Identification**

Case Example:

1. A case report discusses the exhumation of a 10-year-old girl who was kidnapped, sexually assaulted, and strangled. Her body was buried in a secluded place to escape discovery. After about two years, the victim's mother identified her body using personal articles found during the autopsy. This case highlights the importance of careful examination and recording of such items during exhumation.

Overall, exhumation is a significant tool in forensic medicine for uncovering the truth, resolving legal matters, and advancing scientific understanding in cases involving human remains. However, it's delicate and highly regulated process that must be conducted with care, sensitivity, and adherence to legal and ethical standards.



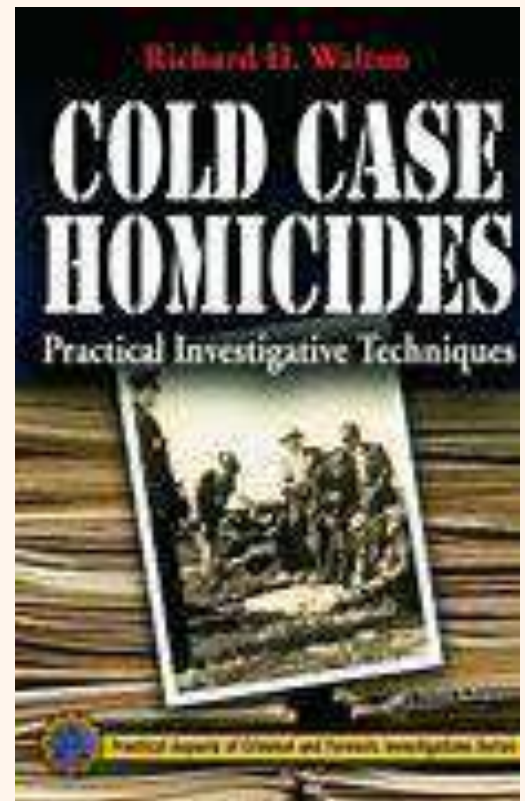
- Beyond contemporary crime scenes, forensic medicine ventures into the realms of history, exhume the truth from the depths of time.
- Archaeological forensics, for instance, utilizes scientific methodologies to analyze ancient remains and unravel the mysteries of bygone civilizations.
- Through techniques like radiocarbon dating and isotopic analysis, archaeologists and forensic anthropologists piece together the puzzle of ancient societies, shedding light on their customs, diet, and even causes of death

COLD CASE INVESTIGATIONS

Cold case investigations in forensics involve revisiting and re-examining unsolved crimes, often years or even decades after they occurred. Here's an overview of cold case investigations in forensic science:

Definition: Cold cases refer to unresolved criminal investigations that have remained inactive for a significant period, typically several years or more. These cases may involve homicides, missing persons, sexual assaults, or other serious crimes.

Challenges: Cold case investigations present unique challenges compared to active cases. Evidence may have degraded over time, witnesses may be difficult to locate or may have unreliable memories, and original investigators may have retired or moved on from the case.



- ❖ In criminal investigations, exhumation can breathe new life into cold cases by allowing forensic experts to reanalyze evidence using advanced technologies unavailable at the time of the original investigation.
- ❖ For instance, the exhumation and subsequent DNA testing of unidentified victims can lead to their identification and the reopening of investigations into their deaths.
- ❖ This process has led to the resolution of numerous long-standing mysteries and the apprehension of perpetrators who had previously evaded justice

Modern Applications in Forensic Investigations



- ✓ **Modern forensic medicine integrates a wide array of advanced technologies and scientific methods to enhance the accuracy and efficiency of criminal investigations.**
- ✓ **Forensic Medicine has seen significant advancements in recent years, particularly in the application of techniques like polygraph tests, narco-analysis, and forensic hypnosis. :**

POLYGRAPH TEST (LIE-DETECTOR TEST)

- A polygraph test measures physiological indicators such as heart rate, blood pressure, respiratory rate, and skin conductivity while a person is asked a series of questions. The underlying principle is that deceptive answers may produce distinct physiological responses.

1. Pre-Test Interview:

2. Calibration:

3. Pre-Test Calibration :

Purpose: Ensure the equipment is functioning properly and establish baseline physiological readings.

- *Sensor Attachment;*
- *Pneumographs;*
- *Galvanic Skin Response (GSR) Sensors;*
- *Cardiograph;*
- *Initial Readings;*

4. Question Formulation

- Monitoring Responses:

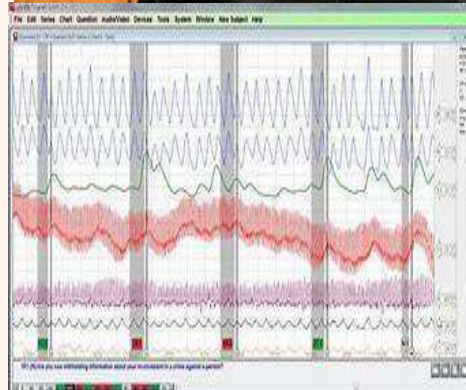
5. Enhanced Accuracy with New Algorithms:

Recent developments in polygraph technology

6. Use in Security Clearance Counterterrorism:

Polygraph tests are increasingly used not just in criminal investigations

7. Legal and Ethical Improvements:



Narco-Analysis Test



- Narco-analysis involves administering a sedative or truth serum, such as sodium thiopental or sodium amytal, to induce a state of lowered inhibitions and increased suggestibility in the subject. The idea is that individuals under the influence of these drugs may be more likely to reveal truthful information or memories that they would otherwise suppress.
- **Narco-analysis is controversial and its admissibility in court varies by jurisdiction. Critics argue that the reliability of information obtained through narco-analysis is questionable and that the technique raises ethical concerns and the infringement of individual rights.**

1. Pre-Test Preparations

- Legal Authorization;
- Medical Examination & Informed Consent.

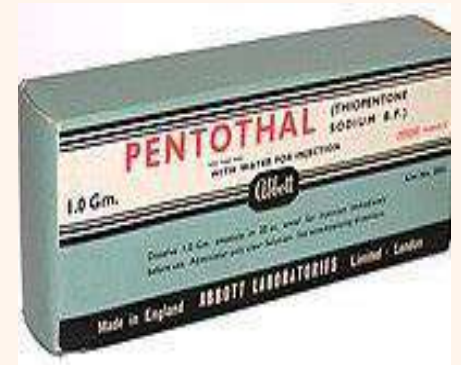
2. Setup

- Controlled Environment & Monitoring
- Equipment

3. Drug Administration

- Selection of Drug & Dosage

4. Interview Process



Sodiumthiopental,
marketed as Pentothal
(Truth Serum)



INSIDE CRIMINAL MIND

HOW IT'S DONE

➤ A narco test is usually conducted when a suspect is continuously changing his/her statements

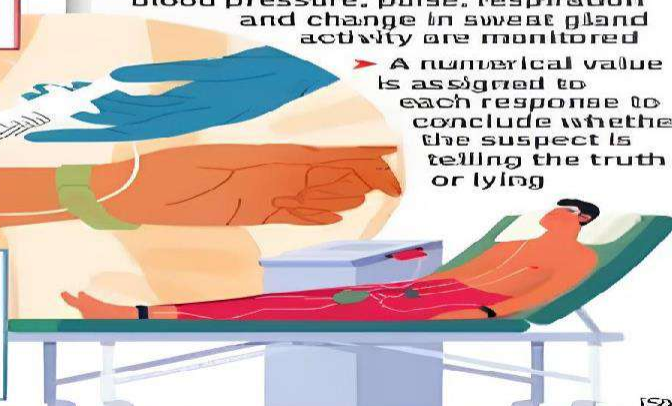
A drug, sodium pentothal, is administered by an anaesthetist

➤ The dose depends on a person's sex, age, health and physical condition
➤ Doctors use different instruments like cardio cuffs and sensitive electrodes for the analysis

➤ These instruments are attached to the suspect and variables like blood pressure, pulse, respiration and change in sweat gland activity are monitored

➤ A numerical value is assigned to each response to conclude whether the suspect is telling the truth or lying

A numerical value is assigned to each response to conclude whether the suspect is telling the truth or lying



Some high-profile cases where it was used



Aarushi murder case | Dr Rajesh Talwar and Dr Nupur Talwar underwent the tests. They were accused of killing their daughter, Aarushi, and help Hemraj

Hyderabad twin blasts | In 2007, one of the suspects were subjected to narco analysis

Nithari killings | In 2005, cops had carried out forensic analysis tests on the suspects

Stamp paper scam | In 2003, Abdul Karim Telgi, the prime accused, had undergone a narco test

FORENSIC HYPNOSIS:

- **Hypnosis in forensic settings is even less common due to the high degree of subjectivity and the ease with which memories can be influenced or fabricated. Similar to narco-analysis and polygraph tests, any use of hypnosis must be consensual, and the information obtained is not directly admissible in court. It is generally used as a last resort to help witnesses recall forgotten details rather than to interrogate suspects**

1. Pre-Hypnosis Preparation

- Medical and Psychological Assessment:
- Environment Setup:

2. Initial Interview

- Assessment of Hypnotizability:

3. Induction Phase

- Relaxation Techniques & Hypnotic Induction:.
- Deepening Techniques & Specific Questioning:

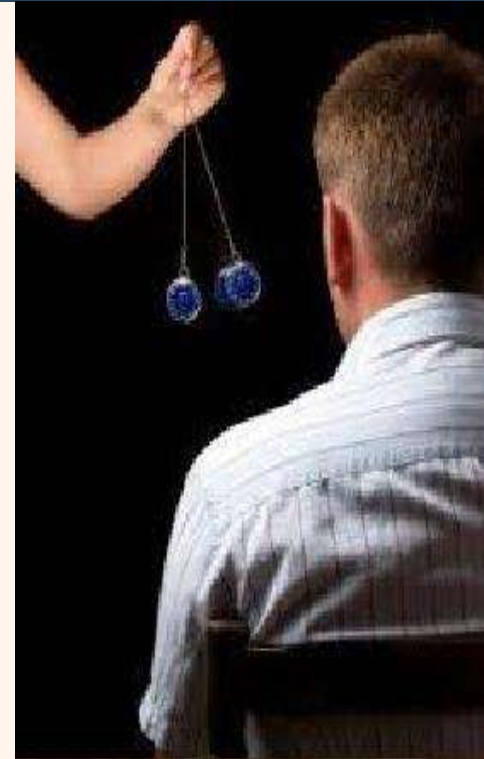
4. Observation:

5. Post-Hypnosis Debriefing

- Gradual Awakening & Emotional Support:

6. Analysis and Reporting

- Cross-Verification & Report Preparation
- Memory Retrieval in Witnesses:
- Enhanced Techniques:



❖ Information gathered through hypnosis can provide leads or corroborate other evidence, aiding the overall investigation process

EEG In Forensic Medicine (Brain Mapping)



Electroencephalography (EEG) is a valuable tool in forensic medicine and the investigation of unsolved cases. It measures electrical activity in the brain and can provide insights into a person's mental state, cognitive processes, and even specific reactions to stimuli related to criminal activities.

Applications of EEG in Forensic Medicine

❖ *Deception Detection:*

- **Brainwave-Based Lie Detection:** EEG can be used to detect deception by analyzing brain responses to specific stimuli or questions. Techniques such as the Guilty Knowledge Test (GKT) measure P300 wave
- *Event-Related Potentials (ERPs):*
- *Assessing Mental State:*
- *Determining Competency & Mental Health*
- *Neuropsychological Evaluation:*
- *Memory Retrieval and Enhancement:*
- *Forensic Hypnosis and EEG:*
- *Trauma and Memory Studies:*



❖ *Cold Case Investigations:*

- Revisiting Evidence with EEG
- Suspect Interrogation
- Victim and Witness Testimonies:
- Enhancing Recall Accuracy

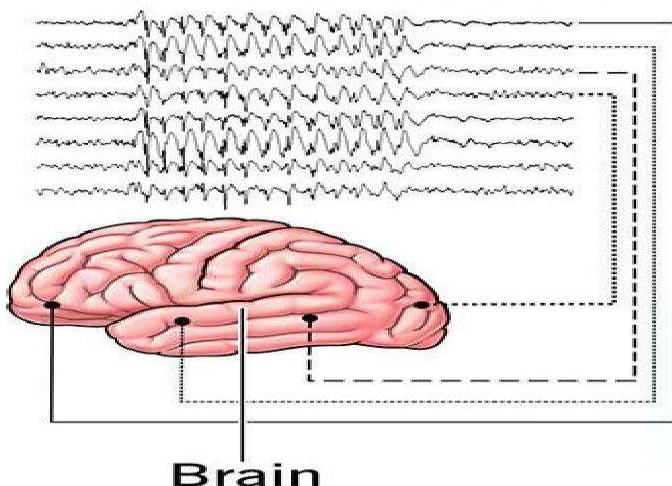


❖ *EEG Setup and Procedure:*

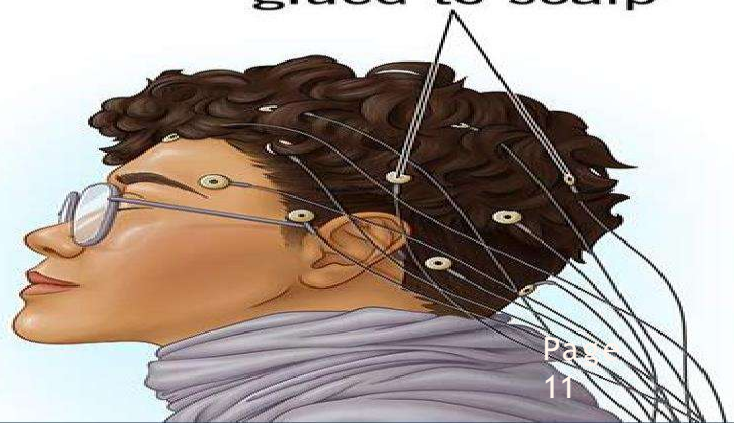
- Electrode Placement & Data Recording and Analysis

Electroencephalogram (EEG)

EEG (scan of brainwaves)



Electrodes
glued to scalp



Ethical Considerations and Legal Framework



"Constitutional & Legal Provisions on these four forensic tests in India"

The Bench went on to say:

""It is our considered conclusion that involuntary exposure to the accused practices violates the prescribed boundaries of privacy," the CJI said.

The Court decided that requiring the use of these procedures would be a violation of Article 20.(3).

The following criteria are intended to ensure that the test is used fairly

- 1) The subject, i.e., the accused, should provide his or her agreement to tests.**
- 2) The subject should be given the option of taking a exam or not.**
- 3) When a subject agrees to a test and provides his agreement to have a test performed on him, he should be aware of the test and its legal ramifications.**
- 4) The subject's assent must be recorded in front of a Judicial Magistrate.**
- 5) The police must demonstrate the court that the accused agreed to the test when the findings are presented to the Magistrate during the hearing.**
- 6) The accused who has been questioned should also be aware of the fact that the words he says during the test are only comments to the police, not confessions.**
- 7) The judge would evaluate the circumstances such as how long the prisoner has been detained and how the interrogation was performed while considering a test.**

CANNOT BE ADMISSABLE AS EVIDENCE IN COURT :

- **The Court decided that requiring the use of these procedures would be a violation of Article 20.(3). Even if the subject had given consent to conduct any of these tests, the results could not be admissible as evidence on their own because "the subject does not exercise conscious control over the replies during the administration of the test."** Any information or material uncovered later with the use of voluntary administered test results, on other hand, can be allowed.

Some Other Modern Applications



1. FACIAL RECONSTRUCTION

Approximation is the process of recreating the face of an individual whose identity is often unknown from skeletal remains. It is a mix of art and science, a subfield of forensic anthropology. This process comes in the forms of a 2D sketch and 3D clay sculpture.



2. DNA SAMPLING

DNA labs often retain previously submitted samples that have not been consumed during the original testing. These unconsumed samples can be used for retesting even if the original item(s) of evidence is not available.

2. DNA SAMPLING

The technique involves collecting, analyzing, and comparing DNA from biological samples found at crime scenes with DNA from known individuals.

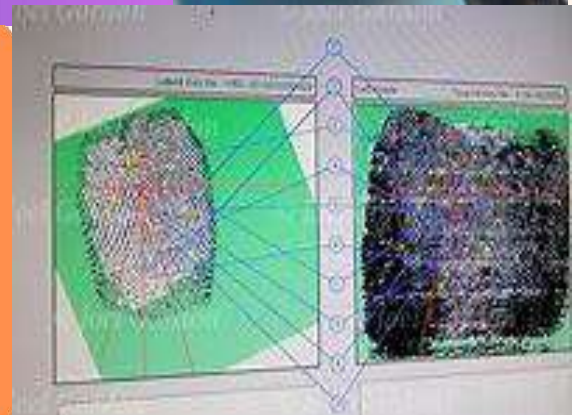
1. Sample Collection
2. Sample Preservation
3. DNA Extraction
4. DNA Quantification
5. DNA Amplification
6. DNA Profiling



3. AUTOMATED FINGERPRINT ID

AFIS, or Automated Fingerprint Identification System, is a forensic tool used to match fingerprints quickly & accurately.

1. Digitization;
2. Feature;
3. Extraction;
4. Database Search;
5. Algorithm;
6. Candidate List;
7. Verification



4. BALLISTICS

Ballistic science is not new and was available to our predecessors, but the processing of ballistics has received important enhancements over years. Fired cartridge casings are 1 piece of evidence that is found often at crime scenes, most collected by investigators; (ATF) National Cold Case Solvability and Using Science in Investigations



CONCLUSION



- The narco-analysis exam, brain mapping, and polygraph and all other forensic investigation tests are nothing but different means of exhuming the truth and solve forensic mysteries and are all quite valuable in the criminal investigative process. In high-profile cases such as the **Aarushi Talwar murder case**, the **Nithari deaths case**, the **Telgi scandal**, and the **Mumbai Bomb Blasts case**, the narco-analysis approach has proven to be extremely useful and successful. Even though it detects lies accurately, it breaches laws such as personal liberty and cannot be used as evidence in a court of law. You can't be your own witness, after all. Furthermore, with a little skill, the polygraphy test can be easily fooled. Results can potentially be used by the police to further their investigation into the matter.
- In conclusion, the diverse array of forensic investigatory techniques is integral to the criminal justice system's ability to uncover the truth. Each method, from DNA analysis and fingerprinting to digital forensics and forensic anthropology
- *This is a bold step. The criminal justice system will be transformed as a result of this action. However, when the accused person demands justice, the validity of the Narco-analysis test is called into question. When all other avenues of investigation fail, the Narco test can be deemed unethical. Every individual is presumed innocent until proven guilty, and every criminal inquiry should follow the same principle.*

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A Message from the Executive Director



Prof. Dr. (Col.) C D S Katoch
Executive Director,
AIIMS, Rajkot

Dear Team and Readers,

I congratulate the Department of Forensic Medicine & Toxicology for bringing this informative newsletter. It will certainly be helpful for the community & medical students. My best wishes to the entire team...

Editorial Team

Department of Forensic Medicine and Toxicology, AIIMS, Rajkot



Prof. (Dr.) Sanjay Gupta,
Professor & Head (FMT)
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We hope you will find this piece of work interesting and informative. This newsletter is our attempt to spread awareness among the community, readers and medical students about exhuming the truth through different techniques in Forensic Medicine. Your suggestions are always welcome.



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