Unit 2

Contemporary Development in Academics and Practices in Forensic Sciences

- The first Central Fingerprint Bureau of India was established in Kolkata in India in the year 1897 and became functional in 1904.
- Ever since then, the usage of Forensic science in crime investigation has routinely started in India and since then efforts are being made for Capacity building of Forensics in India.
- Several State and Central Forensic Science Laboratories were established in India; the Fingerprint Bureaux have also been established in various states.
- At present, there are 29 Fingerprint Bureaux and about 37 State and Seven Central Forensic Science Laboratories in India. Not only this, in several states, Regional Forensic Science Laboratories and District Mobile Forensic units have also been established.
- An advanced Centre for DNA Fingerprinting and Diagnostics (CDFD) has been established in Hyderabad under the Department of Biotechnology, Ministry of Science and Technology, Government of India.
- The Center for Cellular and Molecular Biology (CCMB) Hyderabad, CFSL Hyderabad, and CFSL Kolkata has been the pioneering institutions to start the facilities of DNA Profiling in criminal cases in India after the technology was introduced in London in 1985 by Professor Alec Jeffreys.

Contemporary Development in Academics and Practices in Forensic Sciences

- DNA Profiling in criminal cases such as homicide, suicide, sexual assaults, terrorist activities, wildlife forensics, and other criminal cases is now continuing in various Police departments, Forensic institutions, and Wildlife departments for Human and Animal identification from the biological fluids and the tissue materials.
- There are about 4500 forensic personnel working in Fingerprint Bureau, Forensic Science Laboratories (FSLs), and Chemical Examiners Laboratories in India
- As per calculations, there are only 0.33 forensic scientists per 0.1 million population in India as far as the work of examination of criminal cases and reports preparation is concerned

Contemporary Development in Academics and Practices in Forensic Sciences

- India has over 80 universities and colleges including the National Forensic Science University at Gandhinagar, Gujarat, and Rashtriya Raksha University at Lavad, Gandhinagar where the School of Forensic Science & Risk Management is also imparting teaching, research, and training to the students, Police and Paramilitary forces for security purposes.
- The exclusive teaching and research-oriented staff in the universities and colleges are about 500.
- The Ministry of Home Affairs, Government of India, intends to establish Regional Centers for academic research and training affiliated with the National Forensic Science University, Rashtriya Raksha University, and institutions of National Importance.
- There are about 80 colleges and universities which offer forensic science courses in India, out of which 54 colleges are private and 22 are government institutions. These colleges offer degree, diploma, and certificate courses.

Contemporary Development in Academics and Practices in Forensic Sciences

- Nearly 50–60 thousand unidentified dead bodies have been reported annually in the country which were identified through DNA analysis and by other means.
- The National Crime Records Bureau and the State Crime Records Bureaux possess data about the crimes of missing persons and modus operandi. The data regarding missing persons is also contained by the police at different levels and the data of the dead bodies is compared with the missing persons by the FSLs and the Fingerprint Bureaux for identification purposes.
- The forensic knowledge is imparted to the police and public through print and digital media to act as a deterrent for potential criminals and as a measure of preventive forensics.
- As per the data of May 2020, there are 64 independent post-graduate institutes of medical education and research in India and 554 medical colleges as recognized by the National Medical Commission. These are the main institutes of legal medicine having departments of Forensic Medicine in India. In addition to this, there are district-level hospitals and subordinate health centers which conduct autopsies and medicolegal work.
- The anthropological work pertaining to skeletal analysis and examination i.e. the estimation of the biological profile of the individual and facial superimposition and reconstruction is also carried out in the biological sciences divisions of Central and State Forensic Science Laboratories in India.

Contemporary Development in Academics and Practices in Forensic Sciences

- Moreover, the cases pertaining to the Information Technology Act and Cyber-crime are increasing every year. Thus, India needs more scientifically trained investigators and judges, and equipment for the investigation and adjudication of these cases. The delay and pendency would remain inevitable without the capacity building of Forensics in India.
- The government of India has formed a National Disaster Response Force (NDRF) under the Ministry of Home Affairs, which is a special task force for rescue and relief operations at mass disaster sites. Various NDRF teams work in rescue operations and save the lives of many people after these unforeseen disasters.

Contemporary Development in Academics and Practices in Forensic Sciences

- **Indian Academy of Forensic Sciences:** The Indian Academy of Forensic Sciences (IAFS) was established in the year 1960. This academy started a biennial scientific journal, which assisted as an opportunity for the discussion of concepts in forensic science with other international bodies.
- **The teaching of Forensic Sciences in the Universities:** In the year 1967, Dr. DS Kothari, the then Chairman of the University Grants Commission conventional a high-level commission to advise the Commission on the stages to be occupied for an overview of Criminology and Forensic Sciences in university education. It was recommended that universities ought to be fortified to announce courses in Criminology at the undergraduate courses and postgraduate courses in Criminology and Forensic Science should be ongoing only in a central self-governing institution, which would be affiliated with a university.
- **LNJP National Institute of Criminology & Forensic Science at New Delhi:** The Institute of Criminology and Forensic Science (ICFS) was established in Delhi in 1971 with the limited objectives of imparting training to the in-service personnel and conducting research in Criminology and Forensic Science.
- **National Forensic Sciences University:** was established in the year 2009 with the sole objective of creating professional experts in the field of Forensic sciences. The Government of India has recognized its services to the student communities and the professionals of national and international origin, and has accorded the status of Institution of National Importance and also as a central university in October 2020.

Advantages of Scientific Investigations

- Forensic sciences being an important factor in the criminal justice system plays a vital role in providing scientific information through the analysis of physical evidence to the investigator.
- The information which is present at the crime scene is called *Evidence*, the analysis of which helps in linking the criminal, and the victim with each other and with the crime scene.
- It is mainly concerned with the identification of traces of evidence left at the scene, their scientific analysis in the lab, and finally reconstruction of events.
- The aim of conducting criminal investigations scientifically means to recognize the evidences at the scene of crime which can be analyzed scientifically in the forensic science laboratory and help answer the questions posed by the investigating officer and help to identify the suspected person who has committed the crime. To achieve this aim, the investigation needs to be conducted in the following two places:

1. Crime Scene
2. Laboratory

Advantages of Scientific Investigations

- *Crime scene investigation* is a process that aims at recording the crime scene as it is first encountered and collecting all scientific, potentially relevant physical evidences to provide a solution in a particular case.
- The evidentiary clue materials are received in the laboratory might be very diverse in nature, but the methods used to analyze them some times can have a great deal in common or some time may even be identical. Similarly, various types of patterns are also analyzed and interpreted primarily to provide assistance to reconstruct (sequence of steps) the crime, although the patterns may have been produced by quite different events involving quite dissimilar materials.

SCOPE

- The range of forensics includes either one or all the four following major activities in analyzing and interpreting the physical evidences in the forensic science laboratories:

1. Identification
2. Individualization
3. Reconstruction
4. Job Perspectives

(Reconstruction: a final step of any criminal investigation. It refers to the process of putting together the "pieces" of a case or situation with the objective to reach an understanding of a sequence of past events. It can be achieved on the basis of physical evidence that has resulted from the events)

1. Terminus Post Quem
2. Terminus Ante Quem
3. Terminus Peri Quem

Nature

- The field of forensic science is based on a number of scientific fields, including physics, chemistry, and biology, which focus on the recognition, identification, and evaluation of physical evidence.
- It has become an essential part of the judicial system, as it uses a wide spectrum of sciences to obtain information relevant to criminal and legal evidence. Forensic science can prove the existence of a crime, the perpetrator of a crime, or a connection to a crime through:
    1. Examination of physical tests
    2. Administration tests
    3. Interpretation of data
    4. Clear and concise relationships
    5. A true testimony of a forensic scientist.
- Forensic science has become an integral part of many criminal cases and sentences, with objective facts through scientific knowledge serving both the defense and the arguments of the prosecution.
- The testimony of forensic scientists has become a reliable component of many civil and criminal cases, as these professionals are not worried about the outcome of the case; only with their objective testimony based solely on scientific facts.

Tools and Techniques in Forensic Sciences

- During the forensic science process, the forensic team is used to process samples, tests and hopefully, to solve crimes. Measurements include test analysis, fingerprint detection or identification, drug or chemical analysis and body fluid management.
- It is important to stress that it is the fusion of science and technology that allows forensic scientists to do much of their work. Sciences such as biology, chemistry and mathematics are combined with various technologies to process tests.

1. DNA Profiling: The evolution of DNA technology from the laboratory to forensic science; the conscience applied for legal or court purposes, which involved the scientific and juridical age of humanity from the scientific point of view, the technology of DNA testing technology developed by relative obscurity.

   - Admissibility of DNA in Indian Legal System: (Section 53A) The modification of Cr. P. C. by the Cr. P. C. (Amendment) Act, 2005, has brought two new sections authorizing the investigator to collect DNA sample from the body of the accused and the victim with the help of medical practitioner.

Tools and Techniques in Forensic Sciences

DNA Profiling:

Tools and Techniques in Forensic Sciences

2. NARCO ANALYSIS TEST OR TRUTH SERUM TEST: The analysis of the narco is a process by which a subject is put to sleep or put into a semi- drowsy state by means of chemical injection and then interrogated while in this state of sleep, or the process of injection of a "*truth serum*" drug in a patient /suspected to induce the semi-consciousness and then interrogate the patient /suspect. This process was used to improve a witness's memory.

Tools and Techniques in Forensic Sciences

- **ADMISSIBILITY OF NARCO ANALYSIS TEST:** National Human Rights Commission also published the guidelines in the year 2000 for the Administration of polygraph tests relating to violations of human Rights.
  1. It should not administer without the consent of the accused.
  2. The accused person voluntarily access to the test.
  3. The consent should be recorded before a judicial magistrate.
  4. The accused should be appear with his Lawyer and then court clearly mentioned that this test includes the 'confessional' statement to the magistrate.
  5. The magistrate shall consider all factor relating to the detention includes the length of detention and the nature of interrogation.
  6. The recording of this is done by the private agency in the presence of accused lawyer.
  7. All the narrative statement during the test relating to an offence must be taken on record and submit to a court.

Tools and Techniques in Forensic Sciences

3. POLYGRAPH OR LIE DETECTOR TEST: A polygraph test or the Lie detector test is an instrumental measurement that records the physiological responses relating to the blood pressure, pulse, respiration, and skin conductively which the subject is asked to answer a series of questions for the theory of false answer. The theory behind the polygraph test is that a culprit is righteously caught while getting the results from the measurement of hyperarousal state.

Tools and Techniques in Forensic Sciences

4. FINGERPRINTS: Forensic scientists have used fingerprints in criminal investigations as a means of identification for centuries. Fingerprint identification is one of the most important criminal investigation tools due to two features: *its persistence and its uniqueness.*

TYPES: Patent Prints, Patent Prints, Plastic Prints

- Fingerprints are not the only incriminating patterns that a criminal may leave behind.
- Lip prints are frequently found on glasses.
- Footprints and the soil left on the print may match those found in a search of an accused person's premises.
- Tire tracks, bite marks, toe prints, and prints left by bare feet may also provide useful evidence.
- In cases where the identity of a victim is difficult because of tissue decomposition or death caused by explosions or extremely forceful collisions, a victim's teeth may be used for comparison with the dental records of missing people

Tools and Techniques in Forensic Sciences

5. HANDWRITING: Handwriting is a useful test of identity experiments and observation having disclosed the fact which contains the general principles and questions pertaining to the reliability of the genuineness of handwriting.

- Under Section 47 of the Indian Evidence Act, it is only the opinion of a person especially skilled in questions relating to the identity of handwriting, which is relevant in nature.
- "It is, therefore, for the party, who produces an expert shall have a requisite skill".
- "An expert is one who has acquired special knowledge and skill in any science. His opinion based on observations or experiments is relevant in cases where questions relating to his science arise."
- "If the opinion of the handwriting expert is found by a court to be honest and reliable, after subjecting it to the recognized tests evidence that the evidence of indifferent witnesses whose motives are often mixed and whose powers of observation and recollection are very faulty. The observation of the expert is far more careful and guided by scientific knowledge and skill which, where they exist must be duly appreciated."

Tools and Techniques in Forensic Sciences

6. Cyber Took Kits: Cyber Security Software is a must for the Cyber Security and Privacy of a business or individual. Cybersecurity is the method that is used to protect the network, system, or applications from cyber-attacks. It is used to avoid unauthorized data access, cyber-attacks, and identity theft.

Types Of Cyber Security Tools:

- Network Security Monitoring tools
- Encryption Tools
- Web Vulnerability Scanning tools
- Network Defence Wireless Tools
- Packet Sniffers
- Antivirus Software
- Firewall
- PKI Services
- Managed Detection Services
- Penetration Testing

Tools and Techniques in Forensic Sciences

7. RECONSTRUCTION TECHNIQUES:

A. *Blood spatter:* Stringing Method and Tangent Method
   - SM: sin(angle)= width/length
   - TM: (X)= tan (angle of impact) x distance of a drop
   - Software: Hemospat

B. *Gun Shot Scene*: GSR Analysis, Wound Ballistics, and Fire Arm Analysis.
   - 3D laser scanner + Leica RTC360 software

Qualifications of Forensic Scientists

1. **Undergraduate Course (3 years):** The course curriculum includes the subjects like Criminal Procedure and Evidence, Crime Victim Studies, Constitutional Issues in Criminal Procedures, Fingerprint Analysis, Crime Scene Investigation, Theories of Crime Causation, etc. Students with a bachelor's degree in Forensic science hold entry-level positions like forensic science technician and/or crime scene investigator.
2. **Post Graduate Courses (2 years):- M.Sc. Or PG Diploma in Forensic Science:** Master's degree in forensic science prepares individuals for advanced positions within the forensic science industry. Such candidates can hold senior-level jobs in various departments like crime labs, police departments, and governmental agencies like the Drug Enforcement Administration, hospital labs, medical examiner's offices, and pharmaceutical companies.
3. **Doctoral Course (3 years) (Ph.D. and/or MPhil):** A doctorate is mandatory if an individual wants to seek a lecturing job, research, or opt for advanced leadership positions in Forensic sciences.
4. **Experiences: based on the opportunities**

Code of Conduct of the Forensic Scientists

(To promote the highest standards of professional and personal conduct.)

Professionalism:

1. Are independent, impartial, and objective, approaching all examinations with due diligence and an open mind.
2. Conduct complete and unbiased examinations. Conclusions are based on the evidence and reference material relevant to the evidence, not extraneous information, political pressure, or other outside influences.
3. Render conclusions only within their area of expertise, and about matters to which they have given formal consideration.
4. Honestly communicate with all parties (the investigator, prosecutor, defense, and other expert witnesses) about all information relating to their analysis, when communications are permitted by law and agency practice.
5. Report to the appropriate legal or administrative authorities any unethical, illegal, or scientifically questionable conduct of other forensic scientists or laboratory employees.
6. Report conflicts between their ethical/professional responsibilities and applicable agency policy, law, regulation, or other legal authority, and attempt to resolve them.
7. Do not accept or participate in any case on a contingency fee basis or in which they have any other personal or financial conflict of interest or an appearance of such a conflict.

Code of Conduct of the Forensic Scientists

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Competency and Proficiency

1. Base their opinions and conclusions on scientifically validated and generally accepted methods and tests.
2. Are committed to career-long learning in their forensic disciplines and stay abreast of new equipment and techniques while guarding against the misuse of methods that have not been validated.
3. Are properly trained and competent prior to undertaking the examination of evidence.
4. If applicable, complete regularly scheduled:
   - proficiency tests within their forensic discipline(s);
   - comprehensive technical reviews of fellow examiners' work.
   - verifications of conclusions.
5. Give utmost care to the treatment of all samples or items of potential evidentiary value to avoid tampering, adulteration, loss, or unnecessary consumption.
6. Use appropriate controls and standards when conducting examinations and analyses.

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Clear Communication

1. Accurately represent their education, training, experience, and area of expertise.
2. Present accurate data in reports, testimony, publications and oral presentations.
3. Make and retain full, contemporaneous, clear and accurate records of all examinations and tests conducted, and conclusions drawn, in sufficient detail to allow meaningful review and assessment of the conclusions by an independent person competent in the field.
4. Do not alter reports or other records, or withhold information from a report for strategic or tactical litigation advantage.
5. Support sound scientific techniques and practices, and never pressure another examiner or technician to arrive at conclusions or results that are not supported by data.
6. Accept their moral obligation to assure that the court understands the evidence as it exists, and to present that evidence in an impartial manner.
7. Provide complete and informative testimony, for example by qualifying their responses if needed when counsel attempts to elicit a simple yes or no answer.

Duties of the Forensic Scientist:

Crime Scene

- Protection of the crime scene
- Note Making || Interviewing
- Photography || Videography
- Sketching of the Crime Scene
- Search for the Evidences
- Collection of the Evidences
- Packaging and Labelling
- Documentation
- Preservation of the Evidences.
- Dispatch of the evidences to the respective laboratories.
- Chain of Custody

Duties of the Forensic Scientist:

Laboratory:

1. Analysis
2. Report writing
3. Reconstruction
4. Final opinion
5. Reverification || Proof- Reading the report
6. Maintain the Chain of Custody

Court

1. Presentation of the report.

   (Through written format or in-person; if summoned)

Forensic Expert's Role

- Assignment
- Investigation
- Preliminary report
- Formal discovery
- Final report
- Pretrial preparation
- Trial
- Post-Trial

The expert's written report includes:

- Basic case and evidence identification and dates
- Conclusions and opinions
- Reasons supporting conclusions and opinions
- Rationale or interrelationship between conclusions and the supporting reasons for those opinions.

Report Writing

- "A forensic report, unlike other reports, is written for the benefit of the court and it is typically *about* the subject than *for* the subject. As the primary work product of forensic evaluations, forensic reports usually influence the court's decision as they hold an importance. They require more care than an average report".
- Role in justification of the criminal cases in the courtroom.
- Reports are legal documents.
- Length of the Report:
  - No particular length (Very short or very long reports are mostly not preferred)
  - 3 Types:
    1. Short Reports
    2. Standard Reports
    3. Comprehensive Reports

Report Writing

- Provide accurate information on the examinee's identity and dates of evaluation.
- Describe the manner in which the examinee was informed of the purpose of the evaluation and the limits of confidentiality.
- List all sources of data for the evaluation.
- Clearly state the legal standards that define the forensic purpose of the evaluation, including the specific questions the examiner was asked to address.
- Only report data and not inferences in the dashboard sections and opinions only in the expert opinion section.
- Unbiased, easy language, and avoid any typographical errors/ incomplete sentences

Report Writing

Format of writing a Forensic Report:

1. Statement of Purpose with a disclaimer.
2. Case Details (case name, number, date, examinee name, examiner name and degree, license number, and contact information)
3. Identifying Information.
4. Legal Criteria for Determining Competence to Stand Trials.
5. Observations || Body of the Report
6. Source of Information || List of References
7. Relevant History (Medical or so).
8. Flow Chart (If Reconstruction of the crime scene is performed)
9. Examination Conclusion
10. Expert Opinion (and/or recommendations)
11. Signatures (of the expert and the Proof-Reading expert) with official stamp