



# STATE-OF-THE ART FORENSIC DNA LABORATORY

**CENTRAL FORENSIC SCIENCE LABORATORY, CHANDIGARH  
(AN ISO/IEC 17025:2005 ACCREDITED INSTITUTION)  
DIRECTORATE OF FORENSIC SCIENCE SERVICES  
MINISTRY OF HOME AFFAIRS, GOVT. OF INDIA**

## ABOUT US

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This laboratory started as CID Scientific Section, in 1933. It received major uplift when it was converted into a full-fledged Forensic Science Laboratory of erstwhile Punjab at Chandigarh in 1961. The Laboratory was taken over by the Union Territory, Chandigarh in 1966. After taking over its control under Bureau of Police Research & Development on July 01, 1978, Government of India renamed it as Central Forensic Science Laboratory, Chandigarh. Presently, the CFSL, Chandigarh is working under the administrative control of Directorate of Forensic Science Services, Ministry of Home Affairs, Govt. of India.

The CFSL, Chandigarh has been accredited by National Accreditation Board for Testing and Calibration Laboratories, Department of Science & Technology, Govt. of India and following the International Standard i.e. ISO/IEC 17025:2005 in the field of Forensic Testing .

There are seven divisions viz Ballistics, Biology, Chemistry, Document, Explosives, Physics and Toxicology having high tech examination facilities comprising Automated Firearms Identification System (IBIS System), Bullet Resistant Material Testing and Evaluation, Skull Video Superimposition, DNA Profiling, NDPS Drug testing, Questioned Documents, Post Blast Explosive material, Audio video tape authentication, Automatic Text & Language Independent Speaker Recognition, Digital Forensic, Viscera etc. During the current Five Year Plan, there is a proposal to establish six new divisions viz Forensic Electronics, Narcotics Drug, DNA, Forensic Engineering, Forensic Psychology, Forensic Intelligence as well as upgradation of existing divisions at CFSL, Chandigarh. The CFSL, Chandigarh has also Document Division at Shimla (erstwhile GEQD) involved in examination of questioned documents and computer forensics cases.

The functions of the laboratory are mainly of three fold, firstly, to conduct R&D activities on the various problems of the forensic sciences; secondly, to provide forensic crime case analytical support to the investigating agencies and the judiciary and lastly, to impart specialized training on the forensic science to the forensic scientists, police officers, judicial officers and the other law enforcement officers.

Some major instrumental facilities in the laboratory are SEM-EDXA, Integrated Ballistics Identification System, XRD, FT-IR Spectrophotometer and Raman Spectrophotometer, Computerized Speech Lab, HPLC, GC-MS, LC-MS-MS etc.

Crime rate in the country is increasing day by day and thousands of DNA cases are lying unexamined all over the country. The existing infrastructure of the State as well as Central Forensic Laboratories is not enough to meet the demand of timely disposal of DNA examination especially in Sexual assault and child abuse cases resulting in delay in Justice delivery system. The Govt. of India has taken initiative to establish Nation's first advanced forensic DNA laboratory with latest high through put DNA Profiling tools at CFSL Chandigarh. The foundation stone of Advanced Forensic DNA Laboratory was laid on 1st June 2018 by Smt. Maneka Gandhi Former Hon'ble Minister of Women and child development.

## DIRECTOR'S MESSAGE

On behalf of Team CFSL, it gives me immense pleasure to welcome you to Central Forensic Science Laboratory (CFSL), Chandigarh.

The Central Forensic Science Laboratory, Chandigarh is committed to provide good professional practice and to render quality service to various Investigating and Law Enforcement agencies. Chandigarh, Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi NCR & Uttarakhand are the jurisdictional states of CFSL, Chandigarh. The vision of this laboratory is bright and clear for High Quality, on Time and Credible Forensic Services to the Criminal Justice Delivery System of India.



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Besides above, the laboratory is involved in conducting activities such as Scene of Crime visit, Forensic awareness programmes, R&D Projects and Training to Forensic Scientists, Judicial officers, Police Officers, Investigating Agencies of the Centre and State Governments and Post Graduate Students of Universities.

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Govt. of India has approved and implemented Flexible Complementing Scheme which is a mile stone in better career perspective for the forensic scientists. Several scientists of CFSL, Chandigarh have been decorated with prestigious Union Home Minister's Award for their outstanding contribution in the field of Forensic Science.

Viewers and users are always welcome to give their feedback and suggestions on [cfsi-chd@nic.in](mailto:cfsi-chd@nic.in) to make this website more useful and informative resource on forensic science in India.

**Dr.S.K.JAIN**  
**Director, Central Forensic Science Laboratory**  
**Directorate of Forensic Science Services, Ministry of Home Affairs**

## FORENSIC DNA PROFILING

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Forensic DNA Profiling/DNA Fingerprinting is at its emerging stage in India . The DNA Profiling is a technique in which an individual can be identified at molecular level and is based on the principals of inheritance. Forensic DNA profiling is a very sensitive and reproducible technique that has become one of the most valuable tool in modern criminal investigation, such as human identification in mass disasters, paternity and maternity disputes, identification of victim and suspect in rape and murder cases, child swapping in hospitals, identification of deceased, organ transplanted and immigration. The scrutiny by the court demands more admissible, accurate, and powerful forensic proof for human individualization.

### NEW UNITS AT STATE OF THE ART DNA LABORATORY

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Advanced DNA Laboratory has four independent units fully equipped with modern DNA Profiling tools and techniques:

1. Sexual assault & homicide unit
2. Paternity unit
3. Human identification unit
4. Mitochondrial dna unit



*Sexual Assault and Homicide (Unit-I)  
Paternity (Unit-II)*



*Human Identification (Unit-III)  
Mitochondrial DNA (Unit-IV)*

### TARGETS

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DNA Forensic Laboratory is estimated to increase the capacity to examine to 2,000 cases per year.

### TYPES OF CASES HANDELED

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1. Disputed paternity/maternity
2. Criminal paternity
3. Rape and murder cases
4. Child abuse and sexual assault cases (POCSO)
5. Human identification cases
6. Forensic challenged DNA cases: charred bone , exhumed skeletal remains, touch DNA, trace elements etc.
7. Homicide cases
8. Kinship analysis.

## A NEW CASE RECEIVING FACILITY FOR DNA & BIOLOGY DIVISION

Exhibits storage & preservation facility equipped with CCTV surveillance and Biometric fingerprint scanning.



*Forensic case receiving by the CFSL officers*

## CASE OPENING LABORATORY

- Dedicated Case Opening Area & Sample Processing Facility equipped with advanced still photography and video recording.
- Separate Area for Bone & Tissue sampling.
- Health & Safety Measure
- Pre sterilization facility
- Protective clothing like Lab Coats, Gloves, Face Masks, Head & Shoe Covers.



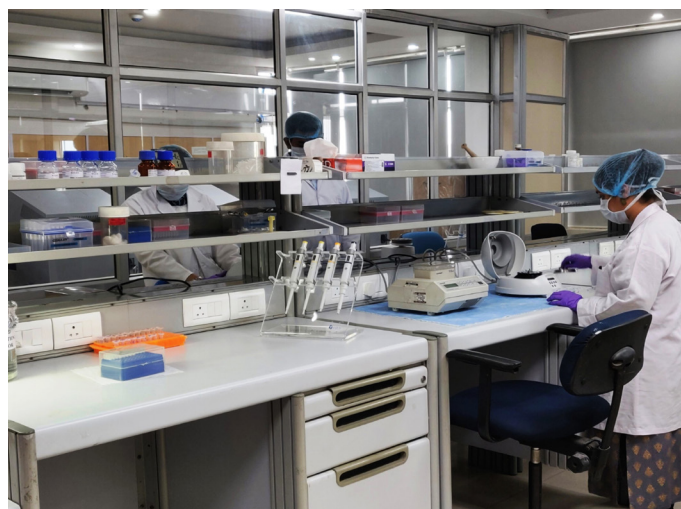
*Photography of Case Exhibits during Case opening*



*Expert taking biological material from the Evidence*

## DNA ISOLATION LABORATORY

- DNA Extraction -I facility for Sexual assault & Paternity Cases.
- DNA Extraction -II facility for Human identification & Mitochondrial DNA Cases.
- Forensic DNA Analysts can work simultaneously for rapid disposal of cases. DNA Extraction laboratories are equipped with latest instruments like Micro & Mini centrifuge, Refrigerated centrifuges, Water bath, Dry bath, Thermo-mixer, vortex, weighing balance, pH meter, Hybridization oven, incubators, pipettes etc.
- Manual DNA extraction method is used for isolation of DNA from bone, tooth, trace and degraded evidence materials.
- Traditional Differential extraction is most suitable method for sexual assaults cases.



*Scientific Analysts performing procedures in DNA extraction laboratory, 5th Floor*

## AUTOMATED DNA EXTRACTION SYSTEM

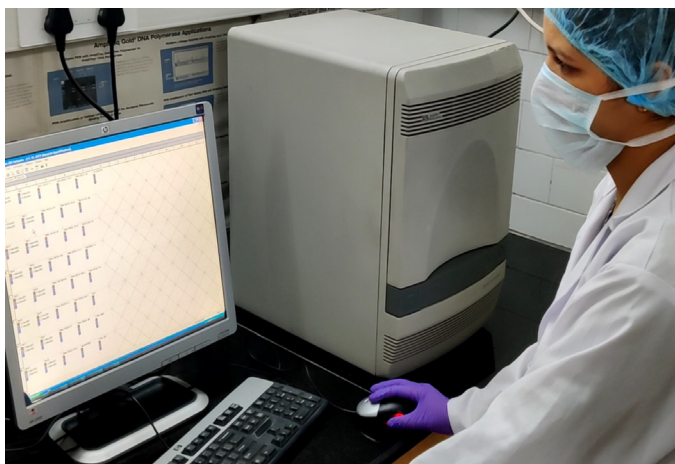
- Advanced DNA facility has five number of Automated DNA extraction systems which will increase the efficiency and reduce the processing time per sample with least manual intervention.
- Rapid method of DNA extraction from reference blood/bloodstains and buccal swabs using Automated DNA extraction systems.



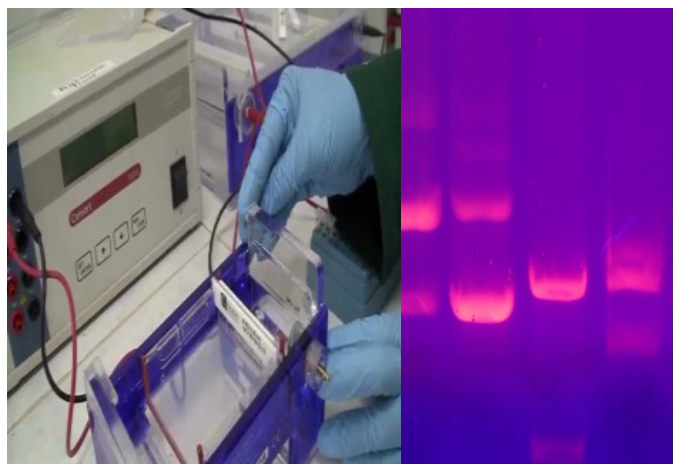
*Scientific Analysts working on EZ1 Automated DNA Extraction system (on left), preparing sample for loading on Automated System (on right)*

## DNA QUANTIFICATION

- Detection and quantification of human DNA from biological samples.
- Gel electrophoresis for qualitative estimation of DNA .
- Real time PCR for quantitative and qualitative assessment of total human and human male DNA . Assessment of DNA quantity and quality guides selection of the appropriate amount of DNA in downstream processes of DNA Profiling using HID kits.
- Determines the ratio of human male to female DNA, even with minute male and excess female DNA in sexual assault cases.
- Real time Machine is highly accurate , sensitive and specific (Male :female ratio, pg/ul, Human or primates )



*Data analysis for DNA quantification using 7500 Real Time PCR system*



*Horizontal Gel Electrophoresis apparatus (left) for Quantification of DNA and Agarose Gel Electrophoresis results (right) under UV illumination with fluorescent bands of DNA*

## PRE- AMPLIFICATION LABORATORY

Equipped with UV HEPA workstation which provide sterilized and contamination free working area for the preparation of amplification reaction.



*Analyst setting up reactions for DNA Amplification in PCR workstation, Pre-amplification laboratory*

## PCR LABORATORY

- PCR machines/thermal cyclers installed for simultaneous amplification of DNA samples using different HID kits.
- Dedicated PCR machines for Evidence and reference samples.



*Thermal Cyclers for Amplification of DNA*



*Analyst setting up programme on Thermal Cycler*



## POST AMPLIFICATION WORK AREA

Dedicated work area for further processing of amplified DNA samples and genotyping on Genetic Analyzer.



*Plate preparation for loading in 3500 Series Genetic Analyzer System*

## GENETIC ANALYZER LABORATORY

- Six (6) Genetic analyzer (8-Capillary) systems installed along with HID software Genemapper ID-X V 1.6 for Fragment analysis and DNA Sequencing.
- Dedicated Genetic analyzers for analysis of Forensic Evidence samples, reference samples and R&D work.
- 08 samples per injection can be run at a time in each machine which will reduce the case examination time.
- Facility of Autosomal STR , Y Chromosome STR,X Chromosome STR & Mitochondrial DNA analysis.



Scientific Analysts working on 3500 Genetic Analyzer



DNA Profiles

## SEROLOGY EXAMINATION LABORATORY

- Preliminary examination of Human body fluids (blood, semen, urine, saliva etc.)
- Origin of species of biological samples
- Confirmatory tests
- ABO blood grouping and P30 test
- Microscopic examination



Microscopic Examination for hair and semen samples



Analysts performing presumptive test for detection of different body fluids



Blood Grouping Examination in Serology Laboratory

## SKULL SUPERIMPOSITION LABORATORY

- Morphological analysis of skull by 2-D and 3-D superimposition Techniques.
- Human Identification of skeletal remains
- Estimation of age, sex, stature and race.





*Anthropometric measurements of skull*



*Skull for anthropometric analysis*



*Evidence samples of human skulls*

## **EXHIBIT STORAGE & PRESERVATION FACILITY**

- Forensic Exhibit Storage & preservation facility .
- Refrigeration facility for storage of biological samples at different temperatures (4°C, -20°C and -80°C)
- Independent cold room facility for long term Storage & preservation of exhibits.
- Provision of Biometric finger print for authorized entry .
- CCTV surveillance.



*Exhibit Storage and Preservation Facility*



*Cold storage facility for store exhibits like foetus at 4 degree Celsius*



*Storage of exhibits at room temperature*



*Refrigeration Facility for Exhibits to be stored at 4 °C, -20 °C, and -80 °C.*



## TRAINING

- Training courses are conducted for newly recruited staff.
- International/national Forensic DNA Lab. exposure of the DNA/Biology experts for establishing & up gradation of the Forensic DNA Laboratory to introduce the latest technology.
- A-state-of-Art DNA Laboratory will organize awareness training programs for Forensic DNA experts, Law enforcement agencies, Medical Officers, Judiciary on application of DNA Profiling, Forwarding of case property, collection and proper storage of Exhibits from the crime scene.

## ACADEMIC SESSIONS FOR TRAINEE

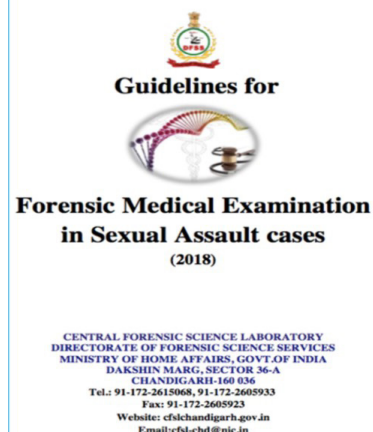
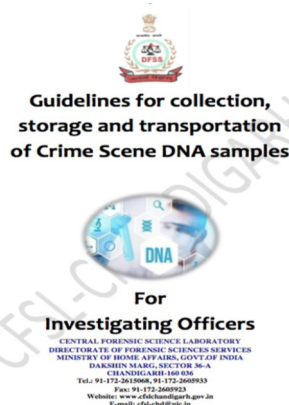
- Weekly or monthly academic sessions are conducted to enhance the efficiency and knowledge of the subject.
- Demonstration on sophisticated equipment and instruments .
- Quality control and management training.

## TRAINING IMPARTED

- Experts of Advanced DNA Laboratory at CFSL Chandigarh provides training and demonstrations to Police officers, Judicial officers, Forensic Scientists, Universities & Institutes and Medical personnel's.
- Special training program conducted for DNA evidence sample collection from crime scene in rape and murder cases in collaboration of CDTs.

## ACHIEVEMENTS

- Advanced DNA Laboratory has issued Guidelines/recommendations for Investigating Officers & Medical personnels for Biological Evidence collection in sexual assault as well as other forensic cases.
- Customized Sexual Assault Evidence Collection Kit (SAECK) for collection of biological samples by Medical Officer .
- Customized crime scene evidence collection kit for collection of biological samples by Investigating Officer .
- The Government of India has approved these guidelines/kits and made them mandatory for investigating agencies and medical officers nationwide.



## **OUTCOMES**

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- A-State-of-the-Art DNA Laboratory at CFSL Chandigarh will act as a model Lab for DNA Profiling and also facilitate other states for the speedy disposal of DNA cases .
- This DNA Laboratory will strengthen the criminal justice delivery system by reducing the case examination time using latest techniques in DNA Profiling.
- A-State-of-Art DNA Laboratory will significantly reduce the pendency of the DNA Case in country by achieving a target of 2000 cases per Annum.
- The Advanced DNA facility is equipped with latest infrastructure and advanced high through-put technologies with automation for disposal of crime cases at faster rate.
- Laboratory is committed to train the forensic professionals in Forensic DNA Testing and generation of human resource in this field for rest of the country.

## **INTRODUCING NEW FORENSIC DNA FACILITY**

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- Mitochondrial DNA Analysis facility.
- Establishing the Next Generation Sequencing (NGS) facility in complex Forensic cases and R&D.
- Establishing the missing person DNA Database for identification of unidentified dead bodies, missing person and disaster victims.
- Creation of reference database of foreign terrorists to check the illegal immigration across the borders and to locate their bio-geographical ancestry.



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