Introduction to Forensic Science and Law

Forensic science, also known as criminalistics, is the application of science to criminal and civil laws.
During criminal investigation in particular, it is governed by the legal standards of admissible evidence and criminal procedure.
It is a broad field utilizing numerous practices such as the analysis of DNA, fingerprints, bloodstain patterns, firearms, ballistics, and toxicology.

Forensic scientists collect, preserve, and analyze scientific evidence during the course of an investigation. While some forensic scientists travel to the scene of the crime to collect the evidence themselves, others occupy a laboratory role, performing analysis on objects brought to them by other individuals.

Still others are involved in analysis of financial, banking, or other numerical data for use in financial crime investigation, and can be employed as consultants from private firms, academia, or as government employees.

In addition to their laboratory role, forensic scientists testify as expert witnesses in both criminal and civil cases and can work for either the prosecution or the defense. While any field could technically be forensic, certain sections have developed over time to encompass the majority of forensically related cases.

- Forensic science is the application of science in investigation used to reconstruct the crime there by it can provide impartial evidence in the court of law.
- Its application always depends upon the occurrence of an crime or events considered as offence in criminal law.
- Criminal law is governed by Indian Penal Code, Code of Criminal Procedure (CrPC) and Evidence Act.
- For justice the gathering of evidence and the legal proceeding against the accused are carried out.
- Evidence is crucial link to establish innocence or guilt.

FORENSIC SCIENCE LABORATORIES

- Forensic Labs Categories

CFSL : Central Forensic Science Laboratory
SFSL : State Forensic Science Laboratory
RFSL : Regional Forensic Science Laboratory
MFSL : Mobile Forensic Science Laboratory

Forensic Science Laboratories category in India

Chemical Examiner Laboratory:
Initially The laboratories were known by this name

Central Forensic Science Laboratory (CFSL):
Under the control of DFSS Directorate forensic Sciences Services , MHA

State Forensic Science Laboratory (SFSL):
Established at state under the control of CFSL

Regional Forensic Science Laboratory (RFSL):
Established at the regional or district level under the control of SFSL

Mobile Forensic Science Laboratory (MFSL):
MobileVan for Rapid analysis of crime scene under control of SFSL or MFSL

Government Examiner of Questioned Document (GEQD) for Question Document Examination under CFSL or SFSL

forum

mid-15c., "place of assembly in ancient Rome," from Latin forum "marketplace, open space, public place," apparently akin to foris, foras "out of doors, outside," from PIE root *dhwer- "door, doorway." Sense of "assembly, place for public discussion" first recorded 1680s.

forensics plural in form but singular or plural in construction : the art or study of argumentative discourse

Year wise progression of crime investigation agencies

S.No	Year	Development in Forensic Science
1	1849	Chemical Examiner laboratory, Madras
2	1853	Chemical Examiner laboratory, Kolkata
3	1864	Chemical Examiner laboratory, Agra
4	1870	Chemical Examiner laboratory, Bombay
5	1892	Anthropometric Bureau, Calcutta
6	1897	Fingerprint bureau, Calcutta
7	1898	Inspectorate Of Explosive, Nagpur
8	1905	Central Finger Print bureau (CFPB), Shimla
9	1906	Government Examiner Questioned Documents (GEQD), Shimla
10	1910	Serological and chemical examiner to the Government of India, Calcutta
11	1915	Footprint Section of Criminal Investigation Department, Bengal
12	1917	Note Forgery Section in Criminal Investigation Department, Bengal
13	1930	Ballistics Laboratory, Calcutta
14	1936	Scientific Sections in the Criminal Investigation Department, Bengal

16	1952	State Forensic Science Laboratory, Calcutta
17	1955	Central Fingerprint Bureau(CFPB), Calcutta
18	1956	Central Detective Training School (CDTS), Calcutta
19	1957	Central Forensic Science Laboratory, Calcutta
20	1958	State Forensic Science Laboratory (SFSL), Mumbai
21	1956	Constitution of Central Advisory committee
22	1959	Sagar University, Madhya Pradesh
23	1960	Indian Academy of Forensic Science (IAFS)
24	1964	Central Detective Training School, Hyderabad
25	1967	CFSL, Hyderbad
26	1968	Central Forensic Science Laboratory(CFSL), (CBI) New Delhi
27	1969-70	Federal Scheme for financial assistance for state
28	1970	Bureau of Police Research and Development (BPR&D), New Delhi
29	1972	Institute of Criminology and Forensic, New Delhi
30	1972	Indian Academy Of Forensic Medicine, Goa

31	1972	CDTS, Hyderabad
32	1978	CFSL, Chandigarh
33	1983	Recommendations of Scientific Advisory Committee to the Cabinet
34	1994	AFIS
35	2002	Directorate of Forensic Science Services (DFSS),CGO complex, New Delhi
36	2010	DFS renamed as Directorate of Forensic science services(DFSS)
37	2011	CFSL Pune, Bhopal and Guwahati
38	2012	CDTS Jaipur
39	2016	CDTS Ghaziabad
40	2019	CFSL Kamrup, Guwahati

Central forensic laboratories in order of time

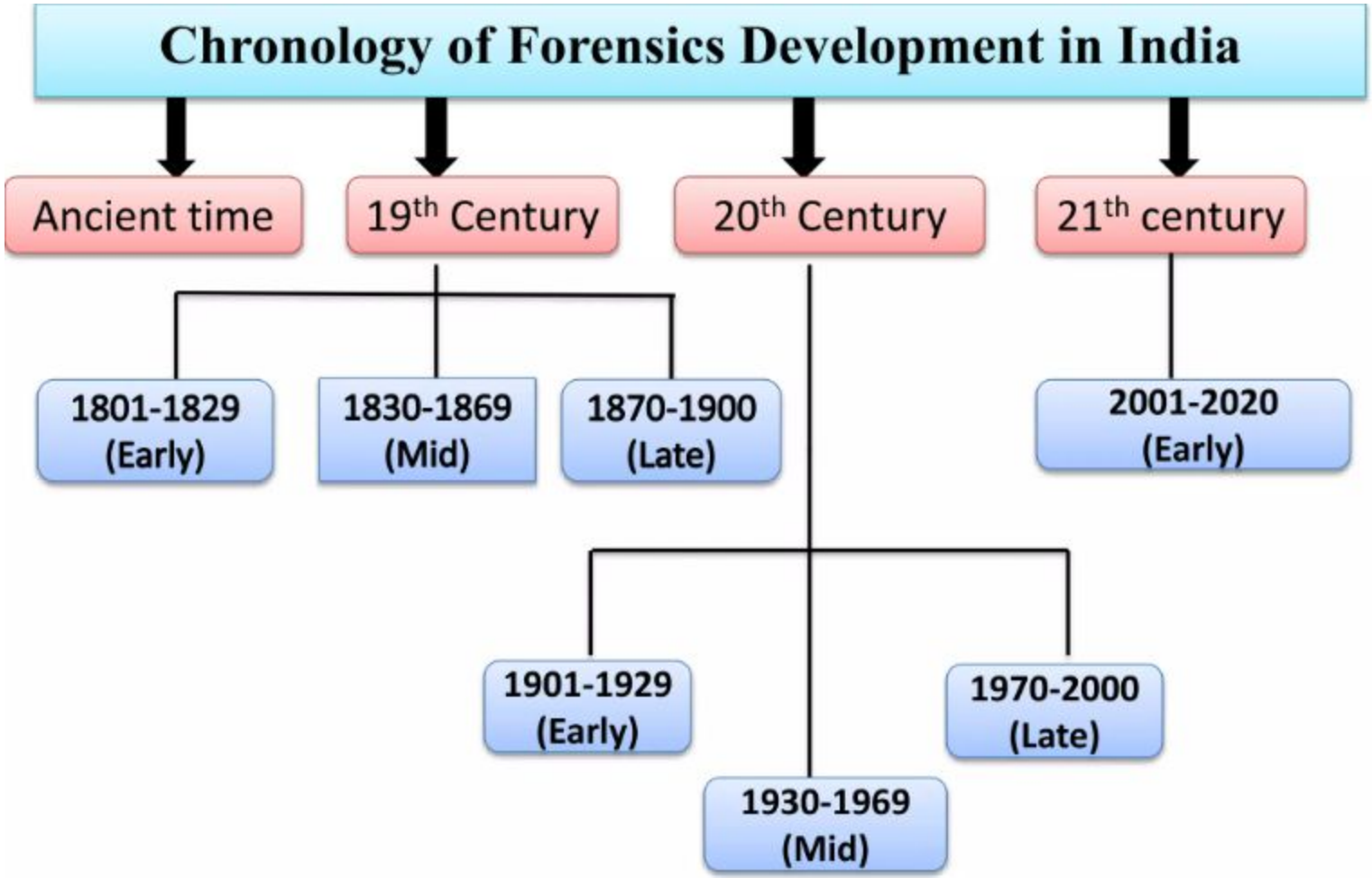
S.No	Year	CFSLs	
		State/UT	Location
1	1957	West Bengal	Calcutta
2	1968	Delhi	CBI, Lodhi road, CGO complex, New Delhi
3	1966	Hyderabad	Telangana(Earlier in Andhra Pradesh)
4	1978	Chandigarh	Sector 36 A, Chandigarh
5	2011	Maharashtra	Pune
6	2011	Madhya Pradesh	Bhopal
7	2011	Assam	Guwahati

Total CFSL: 7

Current status of forensic science in India

S.No	Organization	Old data	Current data
1.	SFSLs / UT FSLs	28	67
2.	CFSLs	-	07
3.	RFSLs	32	79
4.	MFSLs	144	145

Progressive development in Forensic science in India


Chronology of Forensics Development in India
Ancient time
19th Century
20th Century
21th century
1801-1829 (Early)
1830-1869 (Mid)
1870-1900 (Late)
2001-2020 (Early)
1901-1929 (Early)
1930-1969 (Mid)
1970-2000 (Late)

19th Century

1801-1829 (Early)

- **Intentional and accidental poisoning prevalent in India.**
- **Theft, burglary, dacoity and murder.**
- **Use of explosive for mass destruction.**

1830-1869 (Mid)

- **1849** – Chemical Examiner Laboratory, Madras.
- **1853** - Chemical Examiner Laboratory, Kolkata.
- **1864** - Chemical Examiner Laboratory, Agra.

1870-1900 (Late)

- **1870** - Chemical Examiner Laboratory, Bombay.
- **1892-**Anthropometc Bureau at Calcutta, Bengal.
- **1897-** Fingerprint Bureau at, Calcutta, Bengal.

Crime Trends & Major Establishments

Chemical Examiner Laboratory, Madras (1849)

Establishment and expansion	New Expansion	Location	Authority	Why
30th October 1849	Forensic Chemical Examiner laboratory inception	Madras, presently known as Chennai, Tamilnadu.	Government of Madras, under the control of **Medical board, fort St. George, department of health headed by P Thomas Ray.**	Examination of medico-legal cases.
1905	Recruitment of a coin and currency expert	Same laboratory	Head of laboratory, Govt. of Tamilnadu.	To assist police in bribe cases.
1929	Ballistics and Explosive division inception.	Same laboratory	Head of laboratory, Govt. of Tamilnadu.	Examination of firearm and explosive cases.

Establishment and expansion	New Expansion	Location	Authority	Why
1980	The police laboratory and the prohibition and the excise laboratory merged with same lab then known as **Tamilnadu forensic science laboratory (TNFSL).**	Same	Government of Tamilnadu & appointed **Dr. A.R. Natarajan** as the first director.	-
Late 1980	Detachment of Police department then renamed as Forensic Science department.	Same		
1853, 1864 and 1870	Similar Chemical Examiner laboratory	Kolkata, Agra and Bombay respectively	-	-

Anthropometric Bureau, Calcutta (1892)

Establishment and expansion	New Expansion	Location	Authority	Why
1878	Alphonse Bertillon's Anthropometric system was adopted	Calcutta, Bengal	Government of Bengal	People change identity & committed offence like murder, dacoity and robbery.
10th May 1892	Introduction Bertillon system of Anthropometry for the recognition of offenders	Bengal	**HJS Cotton**, the chief secretory of Bengal as instructed by , Secretary of Government of India (GOI) through letter no 263 .	For recognition of offenders. (Identity can be changed but Physical measurement of body remain same)
1892	Anthropometric Bureau	Writer's Building, Calcutta	HJS Cotton, the chief secretory of Bengal	Maintenance of Body Measurement record and examination of cases.

Fingerprint Bureau, Calcutta (1897)

Figure a: Use of fingerprint in contract. (Source: http://ncrb.gov.in/central-finger-print-bureau)

a) In 1858 historical Contract drew between Hooghly Magistrate Sir William James Herschel and contractor Konai using palm print for supplying road making material

b) ICS officer William James Herschel operated from Writers Building.

Figure b: Writer's building at Calcutta (Source:http://ncrb.gov.in/sites/default/files/aibe/02.07.18-CFPB-Flyer.pdf)

Pioneer: **Francis Galton** – Identification and Individualization of fingerprint. Classified into Loop, arch and whorl.

India : **William James Herschel** (Collector at Jungipore, Hooghly in Bengal)
– Fingerprint use for mass identification at Bengal.

Sir Edward Richard Henry (Inspector General of Police)
– 10 Digit Classification system with **Azizul Haque** and **Hem Chandra Bose**.

Establishment and expansion	New Expansion	Location	Authority	Why
1877	Institute was setup for the registration of government pensioner's fingerprint	Hoogly, Calcutta	William James Herschel	To prevent relatives from the collection of pension after the employee's death.
1877	Recorded Fingerprint of Prisoners.	Calcutta	William James Herschel	To prevent the occurrence of fraudulent events to avoid the prison sentence.

Establishment and expansion	New Expansion	Location	Authority	Why
12th June 1897	Resolution passes to introduce fingerprint as an official mode of recognition of criminals in British India.	India	Governor General of Bengal	• Rise in cases of robbery all over India. • Failure of Anthropometric system in identification.
1897	World's first finger print bureau also known as Bengal Fingerprint Bureau	Writers' Building, Calcutta	Government of Bengal.	For maintaining record and identification of fingerprint.
1899	10 Digit Classification system.	Bengal	Azizul Haque and Hemchandra Bose.	For classification and identification of Fingerprint.

20th Century

Crime trend

- Forgery.
- Bribery.
- Murder.
- Misuse of weapon.

Committee

- 1956- Constitution of Central Advisory committee

SCHEMES

1969- Federal Scheme for financial assistance for state.

1901-1929 (Early)

- 1905- Central Finger Print Bureau(CFPB), Shimla.
- Government Examiner Questioned Documents (GEQD) at Shimla.
- 1910- Serological and Chemical Examiner to the GOI, Calcutta.
- 1915- Footprint Section of Criminal Investigation Department, Bengal.
- 1917- Note Forgery Section in Criminal Investigation Department, Bengal.

1930-1969 (Mid)

- 1930- Ballistics Laboratory at Calcutta, Bengal.
- 1950- Introduction of Criminology in India.
- 1952- State Forensic Science Laboratory, Calcutta, Bengal.
- 1955- Central Fingerprint Bureau (CFPB), Calcutta.

1970-2000 (Late)

- 1956-Central Detective Training School (CDTS), Calcutta.
- 1957- CFSL, Calcutta.
- 1959- Sagar University, Madhya Pradesh.
- 1960- Indian Academy of Forensic Science.
- 1968- CFSL, CBI, New Delhi.
- 1970- BPR&D, New Delhi.
- 1972- Institute of Criminology and Forensic, New Delhi.
- 1972-Indian Academy of Forensic Medicine, Goa .
- 1978-CFSL,Chandigarh.

Central Finger Print Bureau (CFPB), Shimla (1905)

Establishment and expansion	New Expansion	Location	Authority	Why
1905	Central Finger Print Bureau (CFPB) (But dissolved due to retrenchment proposal of Inchape committee)	Shimla	Recommend ation of Royal Police Commission of 1902-03.	Apex investigating agency and International organization in all the matter related to Fingerprint science and also assist state fingerprint bureau in all the concerned matters.
1955	Regained fuctionality at Delhi under the control of IB.	Delhi	-	-Do-
August 1956	CFPB mobilized to Calcutta under IB.	From Delhi to Calcutta	-	-

Establishment and expansion	New Expansion	Location	Authority	Why
1973	Administrative control was taken by Central Bureau of Investigation (CBI).	-	-	-
July 1986	NCRB displaced CBI and overtook all its power to control CFPB	East Block-7, R.K.Puram, New Delhi	-	-
1992	Indian Version of Automated Fingerprint Identification System (AFIS) also called "Fingerprint Analysis & Criminal Tracing System" (FACTS)	-	-	-
2018	NCRB visualizes to get hold of a web based application called National Automated Fingerprint Identification System (NAFIS) with latest NIST software.	-	-	-

Government Examiner of Questioned Documents (GEQD), Shimla (1906)

Establishment and expansion	New Expansion	Location	Authority	Why
1904	Post of Government Handwriting Expert of Bengal was created & the then Superintendent in the A.G.'s office known as Mr. CR Hardless was appointed	Bengal	Government of Bengal.	To identify the handwritings on the secret documents connected with the Indian independence movement .
1906	GEQD Bengal mobilized to Shimla under the control of the Director, CID.	Shimla		
1906-1925	C R Hardless was replaced by a police officer Mr. F Brewester. Later by, military personnel R Stott.	Shimla	-	For revealing of invisible writing, training military personnel and investigating bribery and corruption cases.
1944	V O J Hodgson appointed to the post of GEQD	Shimla		For examination of Questioned document.

Note Forgery Section in Criminal Investigation Department (1917):

Establishment and expansion	New Expansion	Location	Authority	Why
1898	Currency Notes Forgery Act, 1898		Secretary Government of India, Legislative Department	Existence of Note forgery crime
1917	Note Forgery Section under CID	Bengal	Government of Bengal	Crime still prevailed

Ballistics Laboratory, Calcutta (1930):

Establishment and expansion	New Expansion	Location	Authority	Why
1857	Indian Arms act (unlicensed possession, sale, manufacture was penalized)	India	**Lord Lytton,** Viceroy of India	Misuse of weapon of any caliber without license
1930	Ballistic Lab under the Calcutta police department	Bengal	British government	Intensified National moments raised the misuse of unlicensed firearms.

Introduction of Criminology in India (1950)

Introduced in India in the mid -20th century, on the recommendations of UNESCO

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In 1950, at New Delhi National conference of state DG of police, IG and DGP of police supported the inception of criminology and forensic courses in Indian universities

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In 18th July 1959, Dr. Hari Singh Gour University in Madhya Pradesh was first to start an independent department of Criminology and Forensic Science, headed by headed by Justice GP Bhat

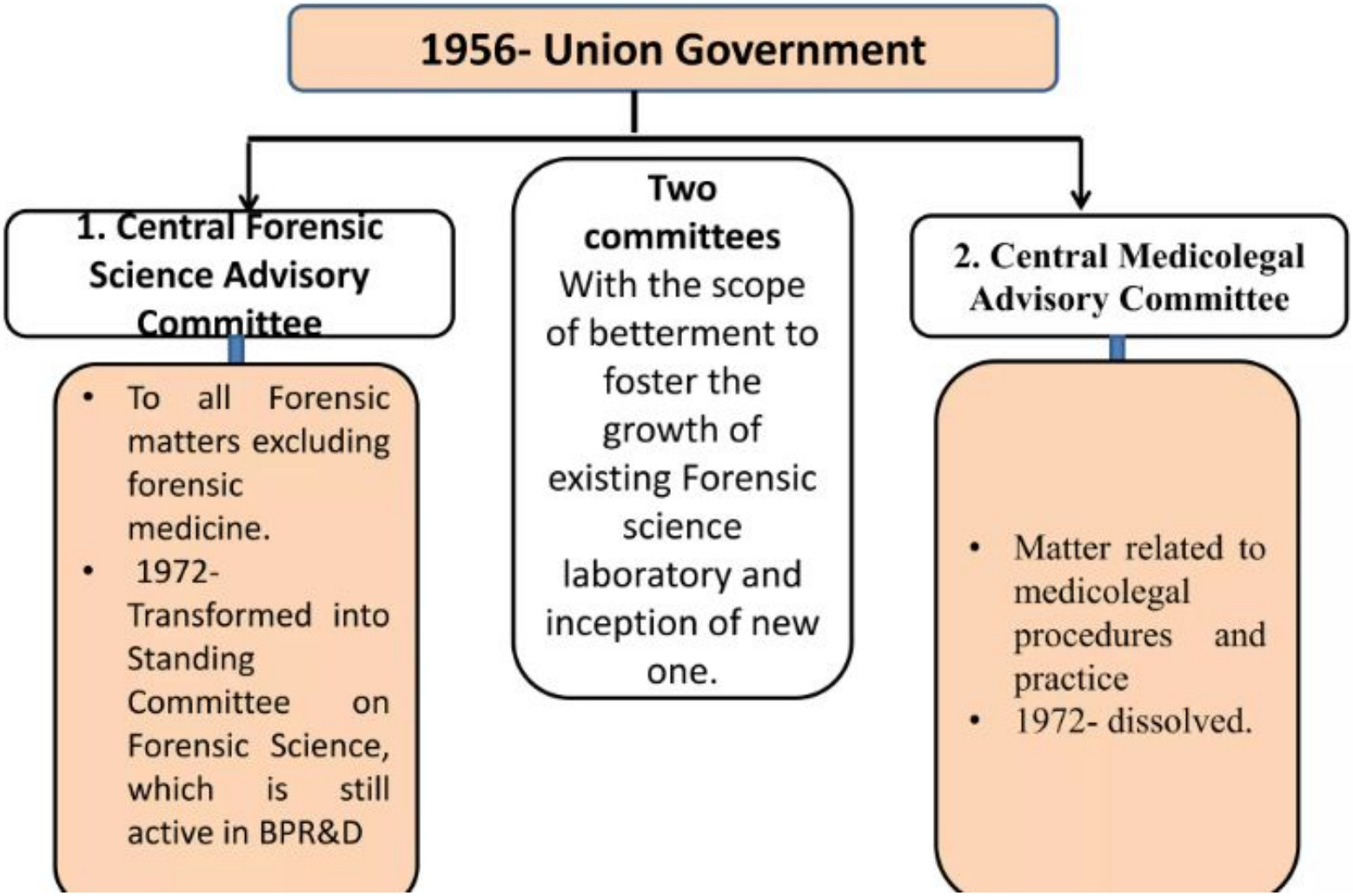
Central Detective Training Institutes(CDTS)

Establishment and expansion	New Expansion	Location	Authority	Why
1956	First CDTS	CFIs building at 30, Gorachand Road, Kolkata , Bengal.	Shri B.N. Mullick, the then Director of Intelligence Bureau.	Aim to disseminate training skills to police officials on the scientific aspects of crime case investigation.
1964		Hyderabad		-Do-
1973		Chandigarh		-Do-
2012		Ghaziabad		-Do-
2016		Jaipur		-Do-

Central Forensic Science Laboratory, Calcutta (1957)

Establishment and expansion	New Expansion	Location	Authority	Why
1957	CFSL, Calcutta	30 Gorachand Road, Kolkata	Ministry of Home affairs(MHA), Government of India	To enhance the scientific analysis support in criminal and civil matters
1970	Neutron Activation Analysis Unit of CFSL, Calcutta	Bhabha Atomic Research Centre, Trombay	Ministry of Home affairs(MHA), Government of India	to extend the analysis to criminal investigation to nuclear method
1998	Received honorable title of "Centre of Excellence " in biological sciences	Kolkata	Ministry of Home affairs(MHA), Government of India	To reform its Character: • Carry Research & Development in field of Forensic Biology. • To conduct scientific examination of crime exhibits. • To train manpower & disseminate awareness about forensic science. • To provide consultancy to FSLs and crime investigation agencies.

Constitution of Central Advisory Committee (1956)



Indian Academy of Forensic Science (IAFS), 1960

In 1960 at 30 Gora Chand road, Calcutta, presided by Dr. H. L. Bami.

Objective- To promote the exchange of knowledge of Forensic Science across the International borders

Started a scientific journal - Journal of the Indian Academy of Forensic Sciences.

Conducted conferences and seminars annually in the field of forensic science.

Role of FSLs

- The role of the forensic science laboratories can be classified under the following-
  - Producing the evidence in a legally admissible form
  - Scientific examination and analysis of clue materials
  - Evaluating the result of scientific analysis and interpreting them
  - Effective use of forensic findings in the prosecution
  - Helping the IOs and police in the following manner:
    - Recognition of evidence material at the scene of crime
    - Collection and preservation of the clue material so recognized
    - Analysis, examination and testifying the forensic findings
    - Interpretation of the forensic clues

Lab Administration; Hierarchy

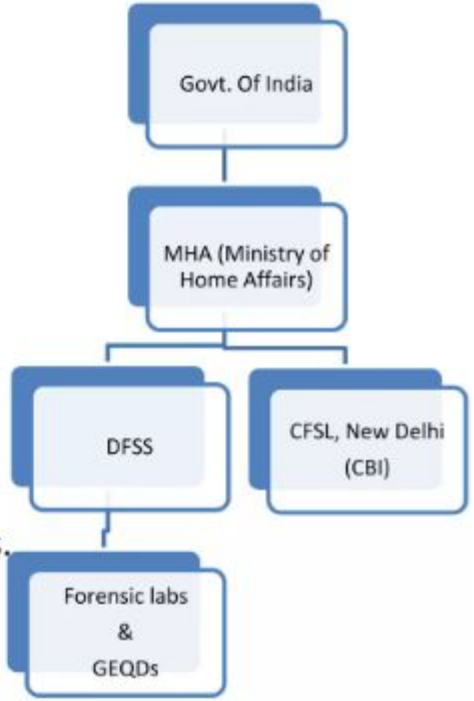
1. Technical Staff
2. Ministerial staff

Director
Additional Director
Deputy Director
Assistant Director
Senior Scientific Officer (SSO)
Scientific Officer (SO)
Senior Scientific Assistant (SSA)
Scientific Assistant (SA)
Lab Assistant (LA)
Lab Attendant
Receptionist/Sweeper/Peon/Helper

DFSS; Directorate of Forensic Science Services

- Established in 2002-03
- M.S. Rao was the founder director of DFSS.
- Role of DFSS-

1. It helps in administration of justice system and provides knowledge & facilities to various training programmes to people involved with justice delivery.
2. It provides the scientific aid in criminal justice system.
3. It guides, regulates and controls the working of Forensic Science Laboratories.
4. Also controls and regulates the working of GEQDs.
5. Provides financial and technical help to State Forensic Labs. (SFSLs).
6. Promotes research & development in Forensic field.
7. To access and review the current procedures & practices in labs.



Divisions of State FSL

A State FSL has the following divisions:

- Documents Division
- Chemistry Division
- Biology Division
- Physics Division
- Ballistics Division
- Toxicology Division
- Serology Division
- Narcotics Division
- Arson & Explosives Division
- Forensic Psychology Division/ Polygraph Division
- Photo Division
- Computer Forensics Division
- DNA Finger Printing Division

Document Division

- Identification of handwriting and signatures.
- Detection of forgeries in signatures
- Examination of typewriting and identification of typewriter & Typist.
- Analysis and comparison of inks and paper.
- Examination/comparison and decipherment of rubber seal impressions.
- Examination of handwriting on unusual surfaces at crime scene, like wall, tree, woodlog, mirror, lifts, curtains, weapons, dead body etc.
- Detection and decipherment of erased, altered, obliterated and indented writings.
- Examination and decipherment of writings between pasted documents,
- examination of adhesive and gums.
- Examination and comparison of printed, cyclostyled, photo and carbon copy writings and signatures
- Ascertaining the sequence of two intersecting strokes and folds on documents
- Reconstruction of charred and torn documents.
- Examination of staple pins/clip marks, punch holes etc. on documents.
- Examination of photocopies/Fax copies and computer printouts.
- Examination of carbon papers and writings thereon.
- Examination of counterfeit and genuine currency, Indian and foreign notes.
- Ascertaining the relative or absolute age of documents.
- Detection of forgeries in travel documents, like passports, traveler cheques, identity cards, credit cards, visas, driving licenses etc.
- Detection and decipherment of secret writings.

Chemistry Division

- Identification of poisons in biological materials (viscera, blood, urine, stomach wash, vomit etc).
- Qualitative analysis of narcotics, Psychotropic substances in accordance with the NDPS Act, 1985.
- Analysis of petroleum products and other inflammable substances in arson cases, including dowry deaths.
- Identification of phenolphthalein in trap cases.
- Acids and alkalis analysis and misc. substances

Biological Division

- Identification of blood, menstrual blood, semen, saliva, sweat, urine, vomit, fecal matter, nasal discharge etc. and their stains.
- Identification of different parts of animal and human tissues.
- Identification, origin and comparison of hair. Remarks whether the hair is naturally fallen, forcibly removed, hammered, cut or burnt etc.
- Identification and comparison of all types of fibres, including wool.
- Determination of origin, sex, age, height & identity etc. from skeletal remains, including teeth.
- Anthropometric comparison of human skull with photograph before finally attempting the superimposition technique for human identification.

Physics Division

- Examination of paints, glass, metal, including medals, coins etc.
- Examination and comparison of tool/cut marks on metals, clothes, paper, leather, glass etc.
- Examination of telegraph wires.
- X-ray radiographic examination of packets, boxes, letter bombs & other secret contrabands as well as currency notes, lottery tickets etc.
- Deciphering of erased/altered numbers on automobiles, cycles, machines, typewriters, firearms and tailor marks.
- Testing and comparison of sealing waxes, stones, statues, electrical wires, machines, motor parts, electric motors, stoves, refrigerators etc.
- Determination of cause of fire whether due to electric short-circuiting or otherwise.
- Determination of direction of force on glass, door, window panes etc. in suicide/murder cases.
- Comparison of fabrics, buttons, soil, seals, printing blocks, printing materials etc.
- Reconstruction of scene of crime.
- Comparison and recognition of recorded voice.

Ballistics Division

- Identification & comparison of bullets, cartridges, cartridge cases, etc. recovered from the scene of crime or the body of the victim.
- Estimation of the range, direction and angle of firing.
- Examination of air guns and country-made/non-standard firearms for their performance and measurement of their muzzle velocities to check their lethality.
- Analysis of live explosive of traces of explosive-residues in post explosion debris to determine the type of explosive involved.
- Identification of explosives and examination of defused/ exploded explosive devices (service/individual/improvised) to determine their operation and origin.

Fingerprint Division

- Comparison of fingerprints on documents to establish their identity.
- Development and lifting of chance prints on exhibits received in the laboratory for examination or by visiting scene of crime in important cases and their comparison with the specimen fingerprints of the suspects/accused to establish their identity.
- Development of chance prints on documents, such as anonymous letter, threat letter, ransom letter and letter claiming the responsibility for terrorist act by using modern chemical techniques.
- Taking of ten-digit fingerprints of living persons.
- Comparison and identification of foot prints/footwear prints.

Lie-Detection Division

The lie detection technique is based on the principle of psychosomatic interactions of an individual, i.e. a change in a person's consciously held feelings produces a psychological defense reaction in the form of physiological changes in his blood pressure, pulse rate, respiration and electrodermal response.

Fear of detection and entrapment induces a person to conceal the facts and this produces uncontrollable physiological reactions, which are precisely measured by the instrument called Polygraph.

The Division provides the following facilities:–

1. Verification of the statements of suspects, witnesses & complainants with the help of a Polygraph machine.

2. To economize and accelerate the process of investigation by screening innocent persons where a large number of suspects are involved.

3. Scientific interrogation of suspects in white-collar crime.

4. Confirmation/corroboration of the findings of investigation by Investigating Officers.

Photography & Scientific Aid Division

I. **Forensic Photography:**

- Photography and videography of scene of crime and crime-related exhibits/objects.
- Photography of accused/suspects.
- General & special photography involving ultraviolet, infra-red and visible radiations of all crime exhibits.
- Oblique light, transmitted light/sidelight photography to decipher indented writings/marks.
- Deciphering of processed photo films in damaged conditions.
- Secret photography involving I.R. and Telephoto-lens techniques.
- Microphotography and macro-photography of documents, numerical, signatures, fingerprints etc.
- Photomicrography of blood, semen, hair, fibers etc.
- Identification of camera and allied equipment from the given photo films.

II. **Scientific Aids:**

- Secret tape recording of conversation under different conditions and its reproduction using special recording devices.
- Secret recordings of telephone conversations.
- Preparation of slides, pictures and posters and their projection for audiovisual display.
- Preparation of audio/ video CDs.

Narcoanalysis (Truth serum)

Close to unconsciousness, the subject is

- Mentally incapable of resistance to questioning
- Incapable of inventing lies to conceal guilt
- Looses inhibition & becomes talkative
- Depresses CNS, ↓BP, slows heart rate
- Susceptible to suggestion & reveals repressed feelings/ memories

Sodium Pentathol and Sodium Amitel

COMPUTER FORENSICS UNIT

- CFU IS UNDERTAKING IMAGING OF VARIOUS STORAGE DEVICES, RETRIEVAL OF DATA/DELETED DATA FROM STORAGE DEVICES LIKE HARD DISC, PEN DRIVE, MEMORY CARD, CD/DVD ETC., EXTRACTION OF DATA, DELETED DATA FROM MOBILE PHONES AND SIM CARDS.
- FORENSIC IMAGING OF VARIOUS STORAGE MEDIA
- TO RETRIEVE DATA / DELETED DATA FROM VARIOUS STORAGE MEDIA(HARD DISK, PEN DRIVE, MEMORY CARD, CD / DVD) AND MANY OTHER STORAGE MEDIA.
- TO EXTRACT DATA FROM MOBILE PHONES AND SIM CARDS.

UFED, .XRF, Mobile forensic, Oxygen, ENCASE, FTK, Mobile Edit

FORENSIC PSYCHOLOGY DEPARTMENT

- Forensic Psychology is the interface between psychology and law. It is the application of psychological principles and knowledge to various legal activities involving crimes listed under the Indian Penal Code. Currently the Forensic Psychology Division, Delhi, FSL undertakes polygraph examination, that is based on the principle of psychosomatic interaction within an individual who is under investigation of various criminal and felony charges like Rape, Murder, Economic Offences, Cyber Crimes etc. Facilities for verifying the veracity of statements of suspects, complainants and witnesses exist in this division.The division is under expansion stages with other Detection Deception Techniques like Brain Electrical Oscillation Signature (BEOS) also under procurement.

Toxicology & Narcotic unit

- Identification of volatile inorganic poisons such as Hydrogen Cyanide, Phosphine, Arsine, Yellow phosphorus, Carbonyl chloride, Sulphonyl chloride.
- Identification of volatile organic poisons such as Chloroform, Benzene, Formalin, Methanol, Ethanol, Acetaldehyde, Acetone, Phenol, Naphthalene, Nicotine, Toluene,Terpentine oil, Paraffin, Halogenated aliphatic compounds, Chloral hydrate, Mineral oils, Pyridine, Aniline, Ethylene dibromide, Carbon tetrachloride and Petrol.
- Identification of non-volatile inorganic anions such as Nitrate, Perchlorate, Chlorate, Fluoride, Selenide, Chloride, Dichromate, Bromide, Phosphate, Manganate, Sulphate, Styphnate, Azide, Chlorite, Nitrite and Arsenate.

- Identification of non-volatile inorganic cations such as , Cd, Hg, Th, Ba, Pb, MN, Bi Cu, Al, Zn, Fe+2 and Fe+3.
- Identification of non-volatile organic neutral compounds such as Chlorinated pesticides, Organophosphorus insecticides, Carbamates, Synthetic pyrethroids, Fungicides, Herbicides, Plant hormones.
- Identification of organic acidic drugs such as Barbiturates, Glutethimide, Hydantoin, Caffeine, Phenacetin, Salicylates.
- Identification of basic drugs such as Benzodiazepines, Alkaloids (Synthetic or of plant origin), Tranquilizers and Phenothiazenes.
- Identification of miscellaneous poisons such as Mineral acids, Alkalis, Organic acids, Organic insoluble like Antibiotics, Sulphonamides, Toxins of poisonous plants, animals and insects

Functions of forensic science

Forensic science is a science that is used to help solve crimes and help give law enforcement an advantage in finding evidence to lead to the correct person who was responsible of the crime. It also helps create the scene for people to know what went on at the crime scenes.

Locard's Exchange Principle can be considered one of the basic concepts in Forensic Science because it reveals the main aspect of how forensic science work which is “every contact leaves it trace”.

The significances of this is that everything at the crime since can either give links to the victim or give clues to the suspect, meanwhile it also shows how the victims can be connected to the suspect.

By doing so, it allows forensic scientist to gather physical evidences to help them and other law informants to understand exactly who, what, when, how, and maybe even why a certain crime was committed. Another function of a forensic scientist is to actually analyze and maybe even experiment on physical evidences, to determine exactly what physical evidences something is or maybe pieces together significant information.

Basically Forensic Science work on 7 Laws.

- Law of exchange
- Law of progressive change
- Law of probability
- Law of individuality
- Law of comparison
- Law of circumstantial fact
- Law of analysis

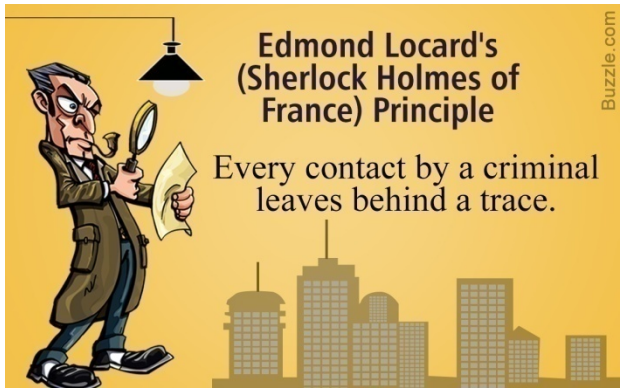
Principles Of Forensic Science

The principles of forensic science guide the disciplines and methodologies of science in analysing the evidence to answer certain questions. These principles of forensic science have an impact upon criminal proceedings which start from the point of investigation upon the occurrence of a crime till the conviction of the accused in the court of law. The principles of forensic science which are significant in criminal proceedings are as follows:

Locards Principle: Sir Adman Locardo, a pioneer in criminology and forensic science, gave the basic principle of forensic science every contact leaves a trace. This principle holds that the perpetrator of a crime will bring something into the crime scene and leave with something from it. This principle is associated with the trace evidence collection at the crime scene

When Two Objects come in Contact there is always exchange of materials.

Dr Edmond Locard (1877–1966), a criminologist.



Law of individuality: Every object individual, natural or manmade, has a distinct quality or characteristic which is not duplicated in any other form or Object.
The most distinctive character associated with law of individuality is fingerprints which has a judgemental role in forensic science.

Principle of Individuality

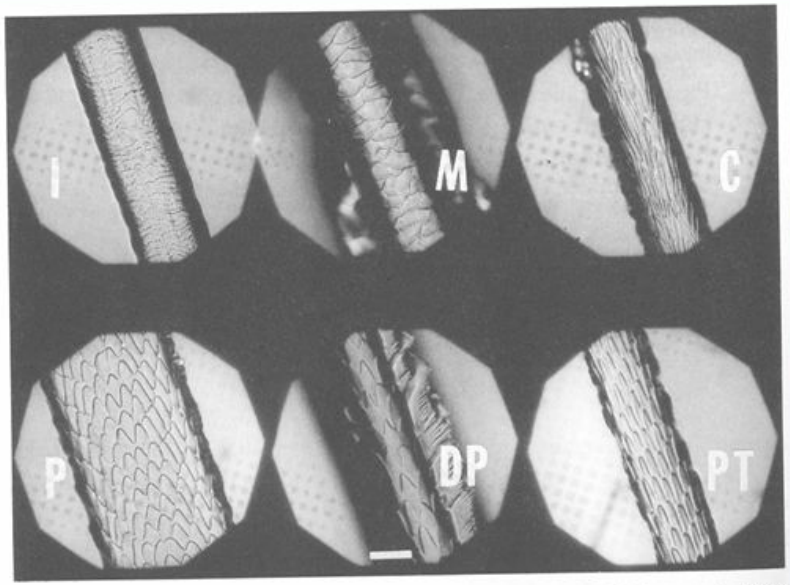


Figure 3. Six primary animal hair scale patterns: imbricated (I), mosaic (M), chevron (C), petal (P), diamond petal (DP), and pectonate (PT).

Two objects may be indistinguishable, but no two objects are ever identical. Things can be put into classes or even individualized in useful ways.

Law of exchange: Law of exchange states that when a criminal or his instrument comes in contact with the victim or the objects surrounding him he leaves some trace behind so that these traces are helpful for investigation purposes.

Law of progressive change: It states that everything changes with the passage of time and its impact on criminal investigation is immense because the crime scene and the criminal undergo changes and sometimes become unrecognizable.

Law of comparison: This principle compares only the people with similar likes whereas people having dissimilar likes are not compared.

Law of analysis: It means collection of the correct samples and their preservation for better analysis. The evidences have to be preserved in the prescribed manner to avoid tampering and destruction.

Law of probability: All the identifications and identities are sometimes consciously and unconsciously correct based on circumstances.

Law of circumstantial facts: Facts never lie but men can lie. Facts cannot be wrong, it cannot lie, it cannot be wholly absent. Therefore the importance of circumstantial facts is good for oral evidence.

Thus Forensic Science is that scientific discipline which is directed to the recognition, identification, individualization and evaluation of physical evidence by the application of the principles and methods of natural sciences for the purposes of administration of criminal justice.

Forensic Document Examiner

- Forensic document expert examines the various types of documents directly or indirectly involved in a forgery case.
- The forgery cases may be of different types, but all these are examined by the handwriting expert.
- From the report of a document examiner, the investigating agency can definitely detect the real culprit of a particular case.
- Apart from the forged signatures or documents, a handwriting expert often gives opinion on typed papers, time of writing and the age of the ink used for writing a questionable documents.
- So the opinion of a handwriting expert also helps the court to a conclusion in meeting the ends of justice.

Forensic Toxicologist

- Forensic toxicologist determines the clues of the crime in which poison is used.
- In any such case, be it accidental suicidal or intentional, a toxicologist analyses the viscera and other relevant materials from which he establishes the quality and quantity of poison used.
- From the report of a toxicologist, the investigating officer can usually obtain vital clues for detecting the criminals involved.
- Similarly, the Court also gets positive evidence for coming to a conclusion in any particular case.

Forensic Serologist

- Forensic serologist has to ascertain whether the particular weapon (e.g knife) is stained with human blood or not.

- Form the findings of a serologist, the investigating officer can get a definite clue in a particular case, depending on which the investigating officer can identify the culprit of the crime.

- It is the serologist who has to establish the facts of disputed paternity cases by testing the blood group in question.

Forensic Ballistic Expert

- A Forensic ballistic expert is the only person who ascertains whether a particular fire arm was used or not while committing a crime.
- He is also to examine the types of fire arms and ammunitions used in commission of a crime.
- He has to establish the facts with regard to firing ranges, distance, direction, and angle of firing.
- After obtaining the opinion of a ballistic expert the investigating officers can come to a reasonable conclusion in respect of a particular crime.
- Apart from the different fire arms and ammunitions a ballistic expert is also to examine the explosive substance which are nowadays very often used for committing heinous crimes.

Forensic Chemist

- Forensic chemistry performs qualitative and quantitative analysis of chemicals found on people, various objects, or in solutions.
- Chemists analyze drugs as well as paints, remnants of explosives, fire debris, gun shot residues, fibers, and soil samples.
- They can also test for a presence of radioactive substances (nuclear weapons), toxic chemicals (chemical weapons) and biological toxins (biological weapons).
- Forensic chemists can also be called on in a case of environmental pollution to test the compounds and trace their origin.
- Forensic chemist has to determine purity of petrol, diesel and kerosene from samples.
- They are also to determine the quality of liquor, opium, ganja and other chemicals, analysis of explosive and the like.
- From their various methods of analysis, they have to establish facts basing upon which the investigating officers can detect the clues of a particular crime.

Education and Scope

1. Professors
2. Associate and Assistant professors
3. Researchers
4. Lab instructors
5. Trainers
6. Legal advisors etc

- Typical job responsibilities
  - Designing and teaching forensic science specific courses: both practical and theory based
  - Conducting and Overseeing forensic science based Research
  - Advising
  - Other administrative responsibilities
- Who they work for
  - Community colleges
  - Colleges and universities
  - Federal, State and Local Law Enforcement
  - Academies

DNA Evidence

- Most common samples obtained are blood, hair, saliva (from cigarette buts or chewing gum), skin, nails, teeth and semen.
- DNA is the main method of identifying people. DNA can be extracted from any of these samples and used for comparative analysis.
- Victims of crashes or fires are often unrecognizable, but adequate DNA can be isolated and a person can be positively identified if a sample of their DNA or their family's.
- Samples are processed to isolate the DNA and establish the origin of the samples. Samples must first be identified as **human, animal, or plant** before further investigation proceeds.
- For some applications, such as customs and quarantine, traces of animal and plant tissue have to be identified to the level of the species, as **transport of some species is prohibited.**
- A presence of a particular species can also prove that a suspect or victim visited a particular area.
- In cases of national security, samples are tested for the presence of pathogens and toxins, and the latter are also analyzed chemically.

Scope of Forensic Science

The 10 sections of The American Academy of Forensic Science (the largest forensic science organization in the world) are:

1. Criminalistics
2. Engineering science
3. General
4. Jurisprudence
5. Odontology
6. Pathology/ Biology
7. Physical Anthropology
8. Psychiatry and Behavioral Science
9. Questioned Documents
10. Toxiology

Tools and Techniques in Forensic Science

Measurements

Microscopy

Photography

Invisible Ray

Chromatography

Electrophoresis

Spectrography

Laser Microprobe

Mass Spectrometry

Spectrophotometry

Neutron Activation Analysis

X-ray Diffraction Analysis

TGA, DTA , NMR and Polarography

Scanning Electron Microscopy

Examination of Clue Materials

Dimensions

Length, Breadth, Height, Depth, Curvature and Diameter

Scale

Elbow Ruler

Calipers

Stopwatch

Thermometer

Ruler

Roll Meter

Micrometer

Beaker Glass

Angle Ruler

Melting point

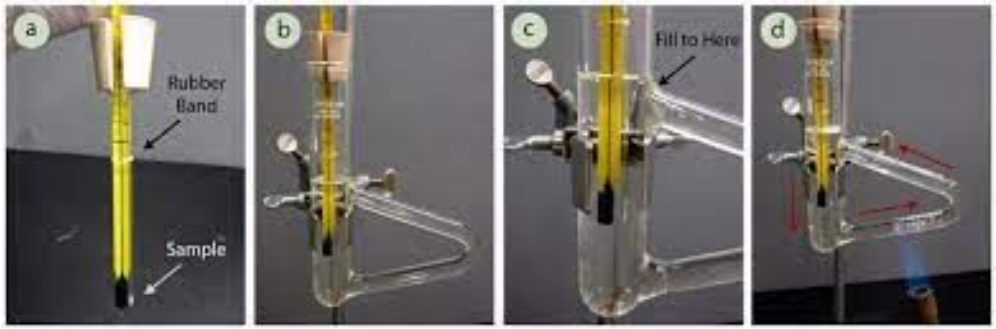
Boiling Point

Densities

Refractive Indices

Birifrenges

Fluorescence



Microscopy

Compounds Microscope

Stereo Microscope

Comparison Microscope

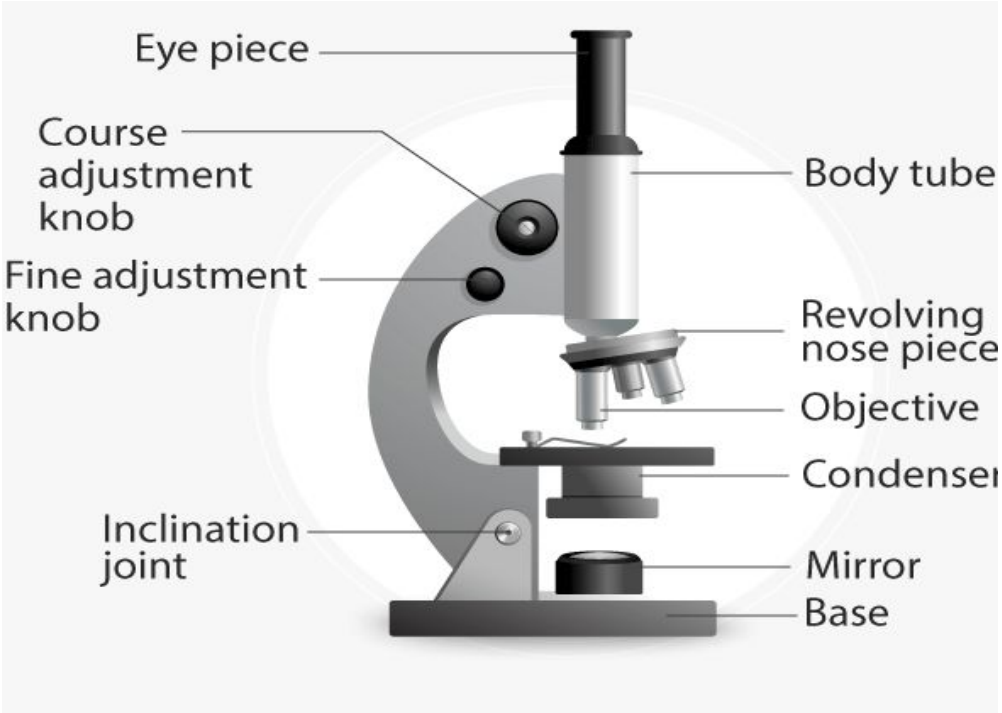
Phase contrast Microscope

Metallurgical Microscope

Fluorescence Microscope

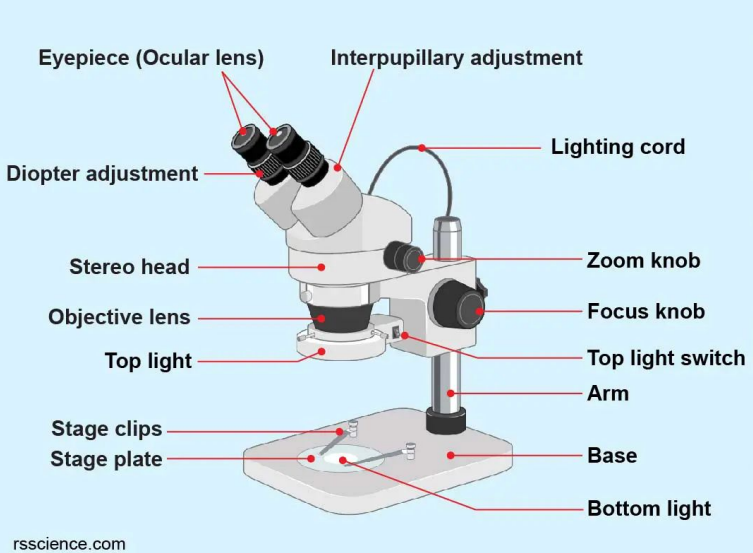
IR Microscope

Electron Microscopy Microscope



Stereo Microscope Parts

- labeled diagram and their functions -



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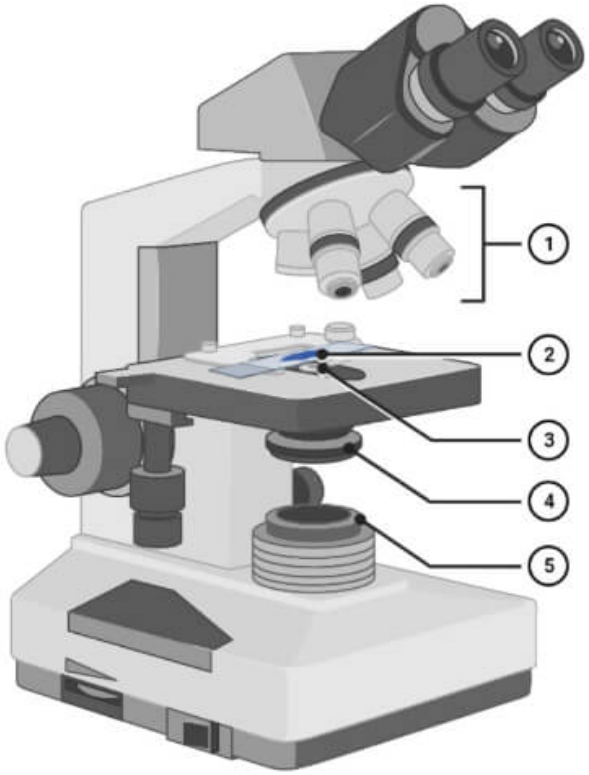
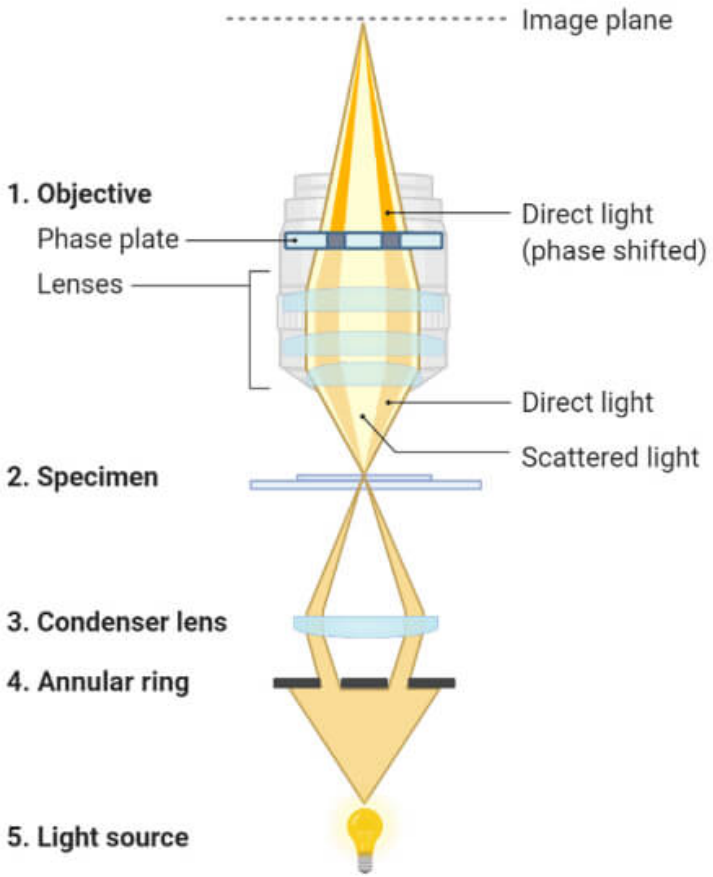
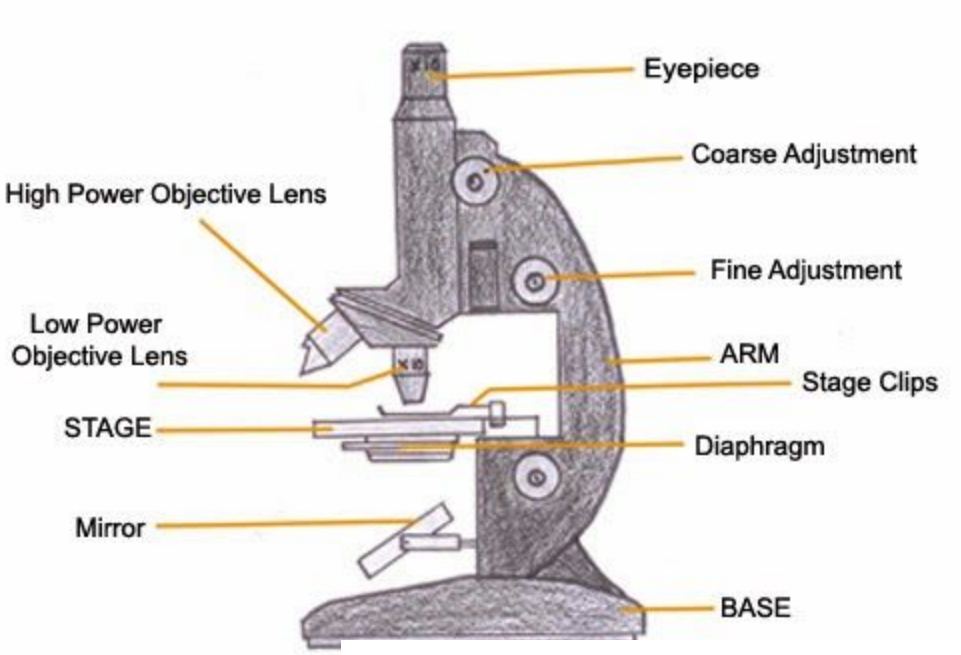
Comparison Microscope

- Consists of two compound microscopes mounted side by side
- Allows two pieces of evidence to be compared side by side.
- Evidence from crime scenes can be matched to suspects.
- Can be used to match bullets, hairs, fibers, etc.

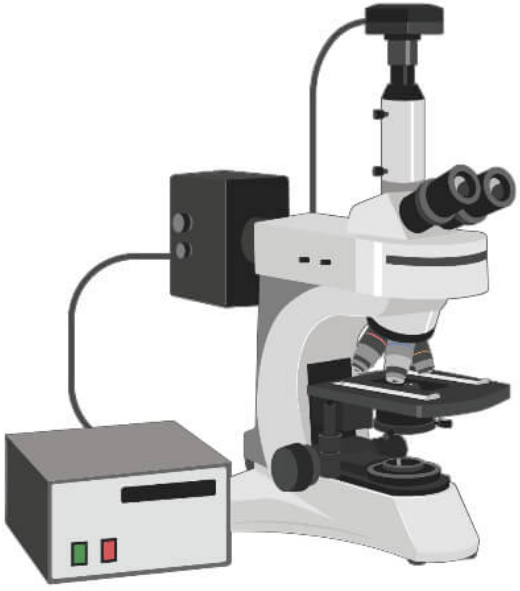
Phase Contrast Microscopy

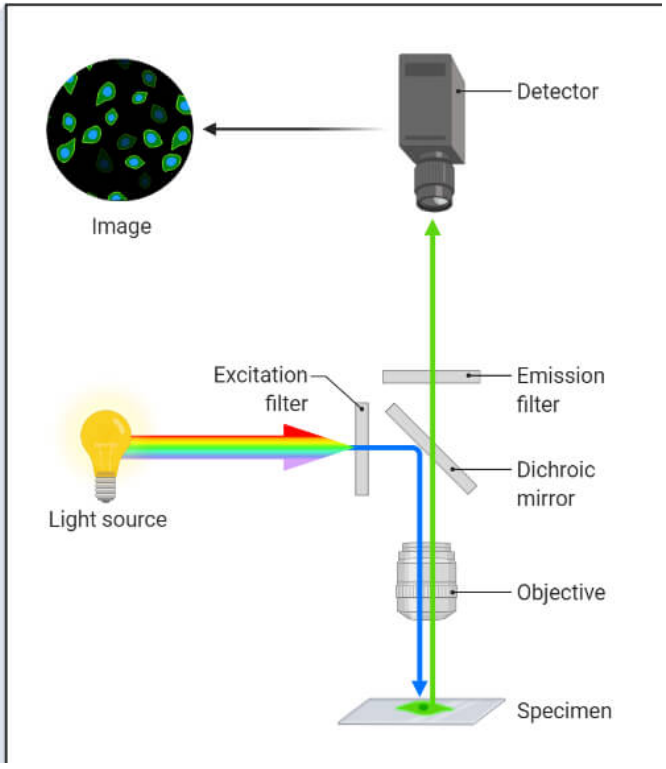


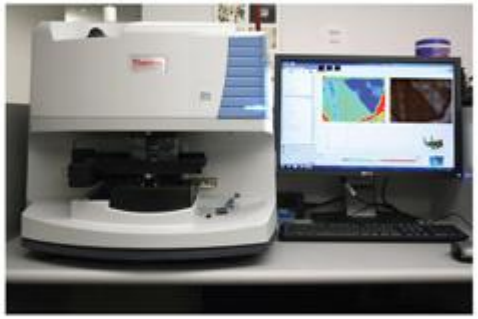


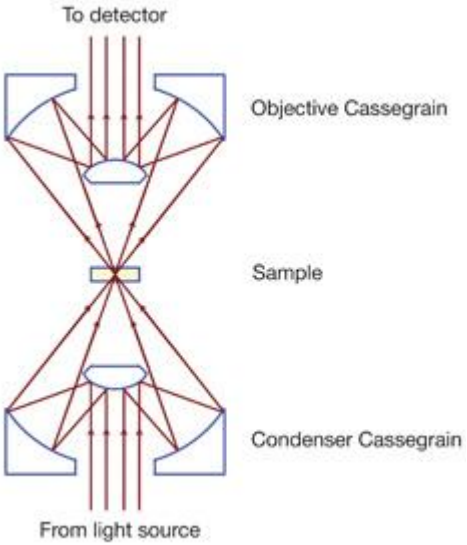


Fluorescence Microscopy

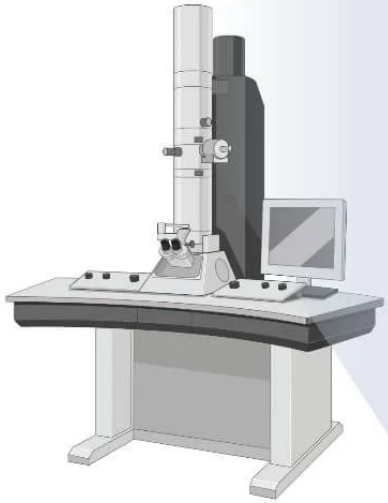


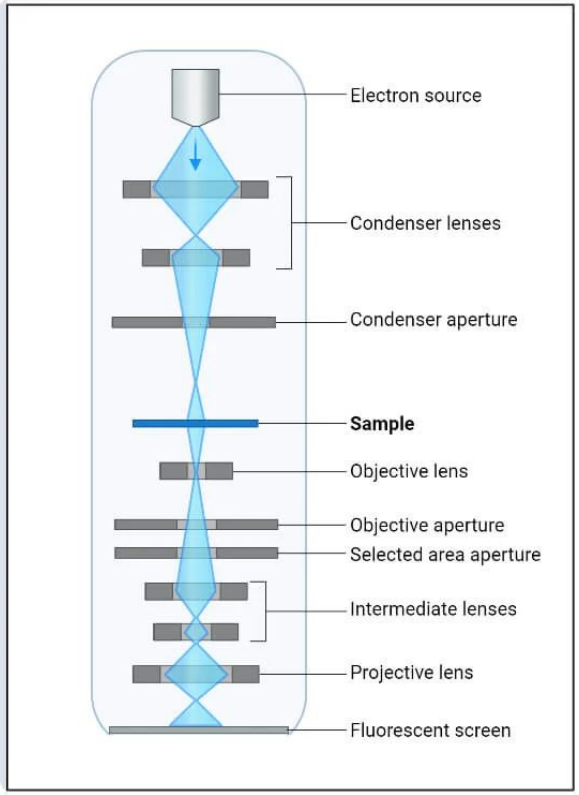


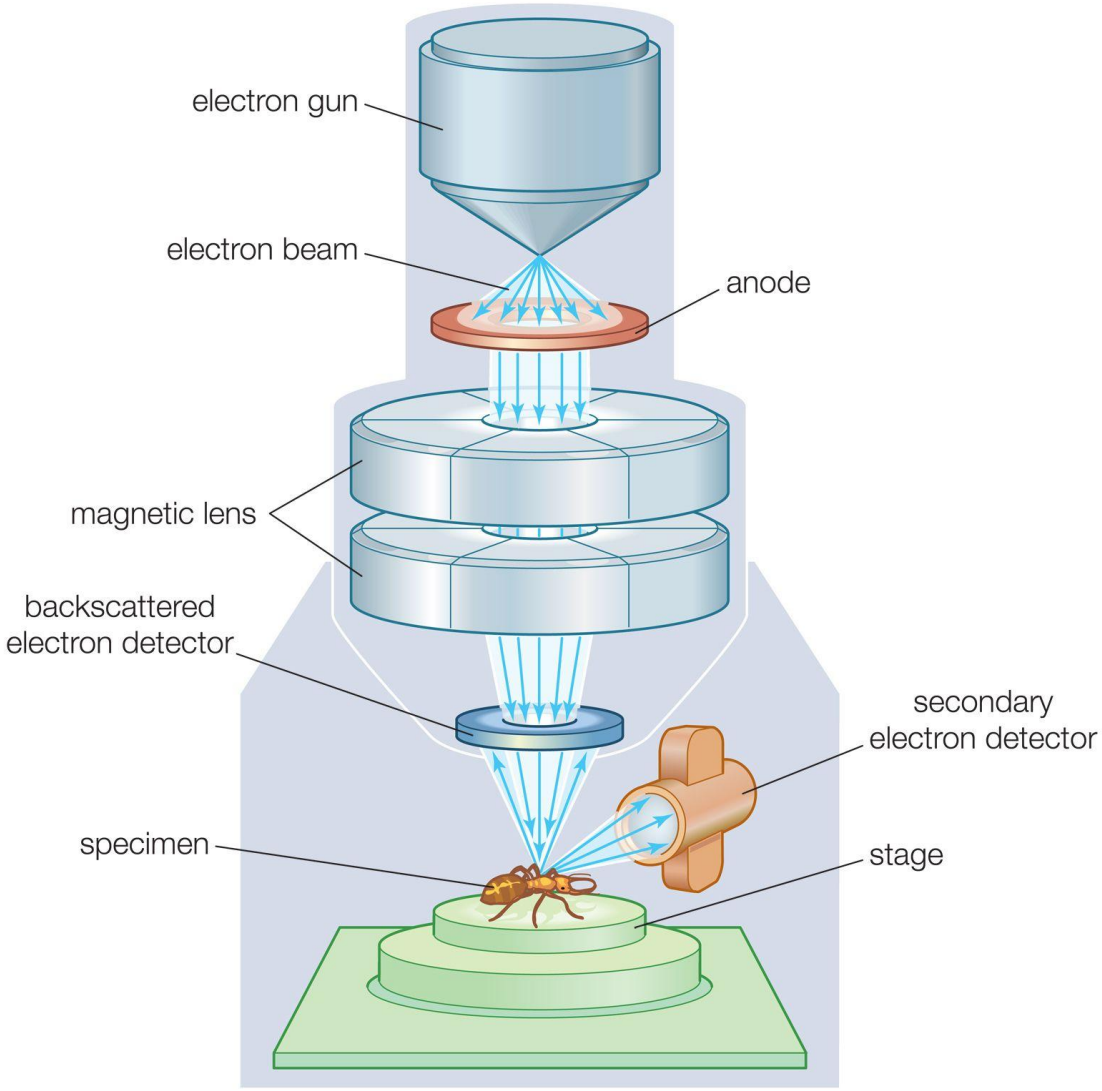




Transmission Electron Microscopy (TEM)






electron gun
electron beam
anode
magnetic lens
backscattered
electron detector
secondary
electron detector
specimen
stage