

A CRITICAL ANALYSIS OF SCIENTIFIC CRIMINAL INVESTIGATION
TOWARDS CRIME DETECTION AND PREVENTION

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Abstract

Scientific criminal investigation becomes most relevant when the fundamental question arises: how are criminals to be identified and apprehended? Crime detection remains one of the most complex and demanding responsibilities of the police. Over the past seventy-six years, remarkable advances have occurred across all branches of science. As scientific knowledge has expanded decade by decade, so too have the tools available for the prevention, investigation, and detection of crime. This development has created a paradoxical race between those who apply scientific innovations to enforce the law and those who exploit similar advancements to evade it.

Technological progress has significantly transformed the landscape of crime. Cybercrime, digital fraud, organized transnational offences, and technologically facilitated violence illustrate how science has reshaped criminal activity. Simultaneously, crime-control technologies—such as DNA profiling, fingerprint analysis, digital forensics, surveillance systems, and data analytics—have strengthened investigative capacity and improved evidentiary reliability.

Scientific tools enhance objectivity, reduce the risk of wrongful convictions, and support stronger prosecutorial outcomes. However, their potential is frequently undermined by systemic challenges, including inadequate forensic infrastructure, delays caused by laboratory backlogs, improper collection and preservation of evidence, and insufficiently trained personnel. Furthermore, the expansion of surveillance technologies and DNA databases raises significant concerns regarding privacy, data protection, and the risk of misuse or overreach.

Scientific criminal investigation, therefore, must function within a sound legal and ethical framework that safeguards constitutional rights and maintains public trust. Technological advancement alone cannot guarantee justice. Its effectiveness ultimately depends on institutional accountability, procedural compliance, professional competence, and adherence to the rule of law. This article seeks to critically examine the use of forensic science by the police and assess whether existing forensic methodologies adequately meet the practical investigative needs of contemporary law enforcement agencies.

Keyword: *Crime detection, crime prevention, scientific investigation, forensic science, reliability.*

1. INTRODUCTION

It has been witnessed that Society is always progressive and it changes faster than law. The law has to keep pace with the scientific and technological advancements in the society. Indeed, society is dependent on science, to such an extent that science and technologies are being utilized in all most all aspects of human life.

Society is not free from Crime. It has been a part of human society from time immemorial. Crime is a social as well as an economic phenomenon, which distresses the whole human society. With the growth and development of society, the nature of the crime has also been changing and diversifying. Before any discussion can be commenced, it is necessary to provide precise definitions of the legal term "crime", Crime can be defined as an action that is against the law, and is harmful to the public welfare or morals. Crime has been present in the human community for as long as the human race existed. There are a vast number of malicious actions aimed at other people, companies, or even countries, many of which are considered criminal offences. To detect and prevent crime it is sometime impossible by using traditional method in the era of advancement of science and technology. This is why various advancements in forensic science has specially been welcomed in criminal investigations. DNA fingerprinting, lie-detector tests, brain mapping, and Narco-analysis testing are all examples of current scientific procedures.

It is to be noted that the development of forensic science has provided a powerful tool in the hands of law enforcement agencies and the judiciary. Anthropometry, finger prints, and foot prints technology, ballistics, serology were essential developed to aid the criminal justice administration. As a result, the barbaric and torturous methods of detecting crime have no place in a civilized society.

Nobody can possibly deny that the centre piece or hub of any investigation is the police officer in charge. Whatever the advances in science, medicine and technology, they can only complement careful, methodical and experienced police investigation, much of which depend upon interrogation. The field of criminology has expanded rapidly during the last few years and the demand for supplemental methods of detecting deception and improving the efficiency of interrogation have also increased. The conventional method of questioning may not equip any result. That is why the scientific tests like Polygraph, Brain mapping, Narcoanalysis etc. are now used by investigating agency in the investigation of a case.

The modern scientific devices of interrogation are valuable technique which would intensely affect both the innocent and the guilty and thereby hasten the cause of justice¹. If these modern scientific tests are adopted, it would assist the investigating agency in finding out the truth and find out the real culprit of the commission of an offence. These modern scientific methods are helpful, when the investigating agency is absolutely in dark and after all efforts there is no clue regarding the offence, the aforesaid tests would help the investigating agency to further investigate the crime and may find some link/clue and may be able to reach to the real accused who has committed the crime.

I. FORENSIC SCIENCE AND ITS DEVELOPMENT

A forensic investigation is the practice of lawfully establishing evidence and facts that are to be presented in a court of law. The word forensic is derived from the Latin word Forensic and means "of or before the forum." It was used as early as the Roman Empire when people accused of crimes were brought before a public group and allowed to argue their case. In modern times, the term is used for nearly all investigations, ranging from computer crimes to murders. When most people think about a forensic investigation, they think about crime scene investigation.

Forensic Science today has shaped the world of justice, crime investigations and signifying the progress of modern technology. Forensic Science of today covers modern computer or clay facial reconstruction, DNA fingerprinting, autopsy techniques, forensic anthropology, toxicology and much more. The developments in forensic science have likewise introduced many vital crime solving techniques over the past few decades. Forensic Science covers the different techniques used to analyse a variety of crimes. These days modern technologies are used to combat crimes like organised crime and white-collar crime as well. Forensic scientific technique is based on application of scientific theory which involves a variety of other natural sciences. The evidence collected by adopting scientific techniques through forensic test result establishes a fact or truth at trial before a court of law.

Forensic Science developed its own exclusive domain that aids the criminal justice administration. In this context it is rightly said that one way to view science is that it is a search for the truth. The use of forensic methods as a tool in the search for the truth allows justice to be done not only by apprehending the guilty but also by freeing the innocent. "Indian criminal justice system has also realized the importance of the use of technology in safeguarding the sentinels of justice and since its inception it is serving as a helping hand to the justice system of the country. Although great advancements have been made in the forensic technology but still "India lacs many advancements which can make the scientific evidence more reliable and emphatic. The law of the country is bound to change due to the revolutionary scientific changes. The modern invention of science and technology shall have serious impact on the law and the administration of justice in any country.

Hence an effort is to be made to make the existing technology more advanced and better so that the criminals can be convicted easily and more reliability can be placed upon the scientific techniques. In this context it is felt very important that the evidence collected through various scientific techniques that involves technical process could be used in the course of criminal trials shall pass muster to the standards of probative utility before the court of law.

The Forensic evidence or scientific techniques generally serves the main purpose of helping the court for arriving at a correct decision and not to demonstrate technological advancement or scientific methods or techniques. Firstly, the

¹*Selvi v. State of Karnataka, AIR 2010 SC 1974*

Forensic evidence associates a suspect or accused to the crime. Secondly the scientific evidence is of general nature and does not associate with a particular person.

For example, if a shoe is recovered from the place of occurrence the scientific test will demonstrate the type of footmarks. But the recovery of semen-stained clothing from the place of sexual assault may point towards a particular person present on the place of occurrence. Therefore, the ultimate purpose of all forensic sciences is to link the accused to a particular crime on the basis of physical sample obtained from the place of occurrence. But the exculpatory aspect of this technique is equally important.

The scientific tests may be employed in two ways that is they may directly use as evidence in court in a trial or they may be used merely as clues for investigation. Where the tests involve the making of a statement, they may be directly adduced in evidence provided they do not amount to a confession because proof of a confession before a police officer or in the custody of a police officer is prohibited.

Forensic science is 'the application of scientific knowledge to legal problems', such as criminal trials, civil disputes, arbitration proceedings, paternity issues etc. These days forensic science is used to investigate all most all crime scenes as well as solving many disputes from domestic to murder to high profile cases. The reasons behind adopting these tests are *modus operandi* of crime commission. The more society is developed with the technology the methods of committing crime become sophisticated and smart. Scientific methods of investigation are a technique designed to either identify the perpetrator or to connect them to the crime so that the accused can be convicted based on unbiased, unquestionable evidence.

In a country like India, there are several issues like population, illiteracy, social setup, stressed police-public relationship, lengthened and complex procedural settlement, poverty and unemployment, role of money and political influences, the eye witnesses often turn hostile etc., thus it deteriorates the prosecution case and the benefit of doubt easily goes often to the accused. For those reasons it has raised a serious challenge to the criminal justice delivery system.

Crime is unavoidable and non-curable in any society and this problem begins from the human civilization. If people were to live together, a social set up for identifying the acts of the people is important. The aim is to identify those people who do not follow the set norms, to punish them and segregate them from the mainstream so that the society will be free from the menace of criminality. This gave rise to the process of finding out the appropriate institutions for the investigation as well as prosecution, so that justice can be imparted fair and unbiased manner.

A forensic scientist plays very crucial role in criminal justice system as he will frequently be asked to provide testimony as an expert witness. Forensic scientist can analyze the test and can submit the scientific analysis of the evidence in legal proceedings. Forensic scientist must be aware about the process involved in being qualified as an expert and evidence collected that will be applied to the scientific analysis performed by the forensic scientists.

Therefore, the responsibility of the forensic scientist is very important. It is not only restricted to the analysis of his experiment/examination of physical evidences or its related reports, but also to guard himself successfully in the court of law. Forensic Scientist is one of the strongest assets of the prosecution who comes forward to reveal the real facts on the scientific findings against the criminal without any fear.

The devices relating to psycho-physiological test namely The Polygraph test, The Brain Mapping test and the Narcoanalysis or the Truth Serum test are the three major tests which are used to interpret the behavior of the criminal and corroborate the investigating officers' observations. There are others too but these three tests are known as modern technique and gained popularity in recent times.

From the very beginning, human being is looking for different ways to separate the truth from that of the lies from those individuals who are engaged in unlawful activities. Various techniques have been tried over the centuries, and it was found that many of these methods turned to be outrageous and brutal. Each technique was based on the assumption that some form of physiological changes occurred within a person when challenged with certain stimuli regarding a specific event. This physiological reaction would, in turn, be manifested in certain detectable symptoms to reveal either honesty or deception. It is believed that, when a person lies, he or she repeatedly becomes anxious and extreme blood flows to the areas around the eyes. This blood flow can be detected by a thermal imaging screener. In India this test is known as polygraph test or lie detector test. It is the most popular test often used to detect lies².

Likewise, Narcoanalysis test involves the intravenous administration of a drug that causes the subject to enter into a hypnotic trance and become less inhibited. The drug induced hypnotic stage is useful for investigating agency because it makes the subject more likely to reveal information. This drug is known as sodium pentothal. Higher dose of this drug is used for inducing general anesthesia in surgical operation. This drug is also used in psychiatry to diagnose mental disorder.

Another component of physiological test is Brain Mapping test or P300 test. It is a process of detecting whether an individual is familiar with certain information by way of measuring activity in the brain that is triggered by exposure to select stimuli³. The measurement of cognitive brain activity allows the examiner to ascertain whether the subject recognized stimuli to which he or she was exposed.

Above mentioned three tests are basically analyses the human psyche and physiological changes if they lie during the time of investigation.

II. LAW – SCIENCE AND TECHNOLOGY RELATIONSHIP *VIS-À-VIS* CRIMINAL INVESTIGATION

² Marvin Dsouza & R.P. Kataria, *Forensic Science in Criminal Investigation*, 8 (Orient Publishing Company, New Delhi, 2018).

³*Ibid.*

Science and law, two distinct professions have increasingly become commingled for ensuring a fair process and to see that justice is done⁴. The legal system today has to deal with novel scientific evidence on several occasions which has posed profound challenges for the law. At a basic level, many of these challenges arise from fundamental differences between the legal and scientific processes.⁵

Scientific evidence as experienced in the past can produce dynamic changes in the course of trial before a criminal court, but they are nothing in comparison to the twists and turns which this evidence produces. In every trial, where any scientific evidence is adduced, the court has to be alert and extremely careful in placing reliance on it. Forensic Science is experiencing a period of rapid change in the wake of the dramatic evolution of scientific evidence and scientific techniques that are used routinely in criminal proceedings. The air of triumphalism here is extraordinary. It is the triumph of reaction against progress and is also the exemplification of the chasm between law and science.⁶

III. APPLICATION OF FORENSIC SCIENCE IN CRIMINAL INVESTIGATION

Forensic Science today makes an important contribution to the operation of the Criminal Justice System providing evidence which could help decide the guilt of a suspect. Forensic Science is able to do so because it has developed to operate within the reality determined by the Criminal Justice System.

Proper investigation into crime involves technicalities, and a criminal investigator must be possessed with full technical knowledge in the field. One of the essential characteristics of investigation is establishing a reliable network of informants and maintenance of surveillance over suspects. An investigator into crimes has dual option of initiating such investigation namely,

- Collection of evidence regarding the crime, in the absence of any direct evidence, and arrive at a conclusion as to its perpetrator, and
- Round up the suspects on presumption and attempt to elicit the truth, by way of extensive interrogation and use of barbaric torture generally known as 'third degree'.

Most of the investigators would generally prefer to resort to the latter, in that it does not entail cumbersome, time consuming and painstaking process of collection of evidence, which is multi-dimensional. But a true and genuine investigator would take recourse to the multi-dimensional process.

Application of science in criminal investigation has marked the beginning of a new era in methods of investigation, rendering the investigators to be dependent on such methods conducted by scientists, through individual efficiency and competency of the investigators are largely eclipsed by the methods. Forensic science is one such area which in recent times has been playing a pivotal role in investigation of crimes, despite the high degree of expenses involved in such methods, generally allowed by the concerned Government.

Discipline of conventional sciences assisting criminal investigation comprise of⁷:

- Physics
- Chemistry
- Biology
- Medical
- Engineering
- Psychology
- Information and Computer Technology

New areas of scientific discipline made applicable for criminal investigation, consists of:

- Portrait Parle photo fit, psychological profiling, voice identification etc., towards identification of living person and cadavers
- Lie detection, brain mapping, Narcoanalysis test etc., as various forms of forensic psychology.
- Police photography, ballistics, serology, handwriting identification, odontology, toxicology, psychotropic drug analysis and DNA profiling.

IV. KNOWLEDGE OF SCIENCE APPLICATION BY INVESTIGATOR

A scientific criminal investigator must be in possession of knowledge of nature and source of inputs, processing of the inputs, and potentialities and limitations of the inputs, in respect of passing on of such inputs to a scientist, for the purpose of availing of scientific assistance in the investigation.

Criminal investigators are faced with challenges, arising out of different nature of crimes committed, terrorism- local, national, international, financial frauds, forgeries, smuggling of fake currency notes, gold smuggling, share market crimes, game betting syndicates, smuggling of gems and precious stones, cybercrimes, drug trafficking and human trafficking etc., are some of the new areas where such investigators need to keep pace with updated knowledge as to their modus operandi. Bombing of the World Trade Centre in New York, in 2001, is a shocking instance where two

⁴*Ibid.*

⁵*Ibid.*

⁶ Dr. Subodh K. Singh, *Admissibility of Polygraph Test in Indian Administration of Criminal Justice System*, 76 (Cri.LJ, Vol 118, March 2012).

⁷ *Ibid.*

airplanes were crashed into the towers, literally converting the planes into explosives, as a new weapon. Such activities are blatant misuse of scientific advancement by perpetrators of heinous crime of highest degree.

Who is a Forensic Scientist? ---- a forensic scientist is first a scientist. When a scientist's knowledge is used to help lawyers, juries, and judges understand the results of scientific tests, a scientist becomes a forensic scientist. In criminal matters, scientific analyses and tests conducted by qualified forensic scientists can exonerate as well as convict an accused person. The work of a forensic scientists is intended to be used in Court and because scientific evidence can be very powerful, the forensic scientist must be accurate, methodical, detailed, and above all, unbiased.

The forensic scientists must conduct the most appropriate test/analyses the document the process. The ability to keep detailed notes and to write clear, concise, and accurate reports is vital. Sometime, at some point, forensic scientists have to testify. Testimony is the verbal statement of a witness, under oath, to the judge, or jury. Forensic scientists are 'expert' witnesses as opposed to ordinary or 'fact' witnesses. Expert witnesses are permitted to testify not just about what the results of testing or analyses were (facts), but also to give opinion about what those results mean.

To qualify as an expert witness, the forensic scientist must have a solid, documented background of education, training, and experiences in the scientific discipline used to conduct the examinations, testing, or analyses about which the forensic scientists want to testify. Sometimes in court, the work or qualifications of the forensic scientist are challenged.

V. ROLE OF POLICE IN SCIENTIFIC METHODS OF INVESTIGATION

The organization of police is made for the security of the public and maintenance of peace in the State. According to August Vollmer, 'A Police Officer must possess the fleetness of mercury, the tenderness of Florence Nightingale, the medical knowledge of a Doctor and the Legal knowledge of a Judge'⁸.

The Father of Nation, Mahatma Gandhi⁹ once said that his concept of Police is entirely different from that of the present-day police. They would be servants of people rather than their 'Swami'. People will themselves help them in all possible ways. With continued co-operation, they will be able to control riots, etc. They would need police behaviour only with thieves and dacoits¹⁰.

Dr. Manmohan Singh, the then Prime Minister of India has also said: 'We need a new-age policeman who is more professional, better- motivated, suitably empowered, well-trained and one who places greater emphasis on technology for investigation'¹¹.

From the very beginning, the existence of police is recorded in books. The word police are derived from the Greek word 'Politeia' or its equivalent 'Politia'. The word 'politia' refers to the State or administration¹².

In the early stage, there was only one king who had the highest authority. He was the supreme head of the legislative, executive and judiciary. He kept his men for security, surveillance and other administrative jobs.

During the Mauryan period, both the civil and the military officials were in existence. Spy system was an important feature of Mauryan administration. The royal agents and the spies could contact the king at any time. They also reported the various aspects to the king. There were some secret agents called 'guptchar' who worked for their king. The work of 'guptchar' was to collect the information for their king from the kingdom¹³.

Mughal rulers changed the legal system of Bharat. They handed over the charge of legal system to the Kazis and Mullahs. The police system was maintained in the times of Mughals. A kotwal was appointed as head of the police administration. He was responsible to maintain surveillance, do the night patrolling and other security duties¹⁴.

Criminal investigation is a very wide term. It is an applied science that involves the study of facts, used to identify, locate and prove the guilt of a criminal. A complete criminal investigation can include Searching, interviews, interrogations, evidence collection, and preservation and various methods of investigation. Modern- day criminal investigations commonly employ many modern scientific techniques known collectively as forensic science.

Researcher has given emphasis on police interrogation which is a part of criminal investigation. And the reasons are:

- The involvement of the police in any crime investigation is very important. Criminal investigation is an ancient science that has roots as far as Cira 1700BCE in the writings of the Code of Hammurabi. The police start investigating a crime as soon as a criminal complaint is lodged. From that very point police with the help of locals, municipalities, government and public prosecutor work together to prevent and combat crime.
- During the time of criminal investigation to know the actual fact of the commission of the crime police interrogate alleged person as well as witnesses and locals who reside nearby the crime scene/place.
- There are multiple techniques employed in interrogation including deception, torture, increasing suggestibility, and other modern scientific techniques.

The theory behind Narcoanalysis test is that a person is able to lie by using his imagination. In the Narcoanalysis test, the subject's imagination is neutralized are reasoning faculty affected by making him semi-conscious. The subject is not in a position to speak up on his own but can answer specific and simple questions. In this state it becomes difficult for

⁸August Vollmer, available at https://en.wikipedia.org/wiki/August_Vollmer (last visited on 15.3.2025 at 12:30 pm).

⁹M.K. Singh, *Interrogation and Investigation polygraph and Brain Mapping test*, 12 (Published by Lucky International, New Delhi, 2016).

¹⁰ *Ibid.*

¹¹ *Ibid.*

¹²<https://egyankosh.ac.in>. (last visited on 15.3.2025 at 12.10 pm).

¹³ *Ibid.*

¹⁴ *Ibid.*

him to lie and his awareness would be restricted to facts he is already aware of. Narcoanalysis test is a scientific test conducted by experts and it is very much true that, it has got adverse reactions also. It is advisable that before conducting Narcoanalysis test precautionary measures must be taken¹⁵.

Another commonly used modern scientific aid is polygraph test. A polygraph also known as lie detector measures and records several physiological indices such as blood pressure, pulse, respiration, and skin conductivity while the subject is asked and answers a series of questions. The belief is that deceptive answers will produce physiological responses that can be differentiated from those associated with non-deceptive answers. This technique is also known as deceptive detecting techniques.

Third important component of scientific aid which is often used in India is brain mapping or p300. The brain mapping test is also known as P300 test or Brain fingerprinting or Brain Electrical activation profile test (BEAP). To help the investigating agencies in finding out the truth this deceptive detecting technique is very useful.

Proper investigation into crime involves technicalities, and a criminal investigator must be possessed with full technical knowledge in the field. One of the essential characteristics of investigation is establishing a reliable network of informants and maintenance of surveillance over suspects¹⁶.

Investigation in its generic sense, investigation is thorough inquiry into a situation or its systematic examination, and criminal investigation involves minute and rigorous inquiry into the occurrence of a crime, with the object of unravelling the cause of leading to such crime, coupled with collection of evidence and garnering of legal evidence in the kitty of the investigator, against perpetrators of a crime, and finally nailing the criminals¹⁷.

It is a fundamental duty of the police to conduct investigation in every case that is reported. Interrogation and questioning are integral parts of police investigation. The police gather crucial information by asking questions about the alleged offences. It is every person's duty to provide correct and accurate information to aid police investigation when called upon to do so.

Investigation is a preliminary stage conducted by the police and usually starts after the recording of a First Information Report (FIR) in the police station. If the officer in charge of a police station suspects the commission of an offence, from the statement of FIR or when the magistrate directs or otherwise, the officer or any subordinate officer is duty bound to proceed to the spot to investigate facts and circumstances of the case and if necessary, takes measures for the discovery and arrest of the offender¹⁸.

Investigation ends in a police report to the magistrate. Inquiry consists of a magistrate, either on receiving a police report or upon a complaint by any other person, being satisfied of the facts. The Constitution of India provides that Police is a 'State Subject'¹⁹. The states are responsible to maintain law and order in their state. But, in case of internal disturbances, the Centre is responsible to protect the states and to intervene in the law-and-order problems of states²⁰.

It is very pertinent to mention here that the influence of television programs showing the use of highly sophisticated analytical equipment to solve crimes has made the juries to come to expect complex scientific evidence to be presented in all criminal cases. Now-a-days TV channels, like Sony, Life OK and Colors are showing the crimes occurred in the past. Sony TV shows CID, Life OK Savdhaan India and Colors Code Red. The real story makes the viewers much more aware about the crime techniques; on the other hand, criminals are learning how to commit the crime intelligently.

The traditional tools of investigation are becoming non-available, non-reliable, obsolete and ambiguous. The judiciary requires a very high standard of proof. The computer, the internet and cyber space have brought in highly complex crimes. No crime scenes, no crime time frames, no jurisdictional crimes, they are baffling the traditional trackers of crime. This may be the reason for accepting scientific techniques. The scientific methods are efficient, certain, specific, rapid, verifiable and unbiased. The scientific methods are always available, applicable in all situations and investigations. Apart from the positive aspects there are some drawbacks also. The aim of the investigation and, in fact the entire criminal justice system is to search for truth. But to achieve this objective, the investigating officers must be properly trained and supervised and necessary scientific and logistic support should be made available to them.

The police perceive themselves psychologically and morally bound to do everything possible to curb crime and investigate the cases successfully to meet the people's expectations. In this process police often resort to short cut methods and exhibit negative traits of police sub-culture, namely rudeness, use of third-degree methods, defensiveness in face of criticism, lack of innovativeness etc.

Even though investigation is the foundation of the criminal justice system it is unfortunate that it is not trusted by the laws and the courts. Sections 168 and 169 of the Bharatiya Sakshya Adhiniyam, 2023²¹, **Section 168** provides that when a witness refreshes his or her memory by referring to any writing or document, the adverse party has the right to inspect

¹⁵A. Ramen Kumar Singh, '*Role of police in the society*' 46 (GLT, VOL.1, 2012).

¹⁶ *Ibid.*

¹⁷ *Ibid*

¹⁸The Criminal Procedure Code 1973 amended and replaced as Bhartiya Nagarik Suraksha Sanhita, 2023 (BNSS) section 173.

¹⁹ The Constitution of India, Distribution of Legislative Powers between the Centre and the State, List 2, Entry 2.

²⁰ Article 355 of the Constitution of India, P.M Bakshi, *The Constitution of India* 292 (14th edition, Lexis Nexis, Gurgaon 2017).

²¹ Bharatiya Sakshya Adhiniyam, 2023

that document and cross-examine the witness on it. This ensures fairness and transparency in the use of documentary material during testimony.

Section 169 states that a person summoned to produce a document must bring it before the Court, and the Court shall decide on its admissibility. The Court may inspect the document unless it relates to matters of State privilege, thereby balancing evidentiary requirements with confidentiality concerns.

The confession made by the accused is also not admissible in evidence. The statements recorded at the earliest stage normally have greater probative value but can't be used in evidence. The observations of the courts in several criminal cases show that the judges are reluctant to accept the testimony of police officers. Such is not the position in other countries.

It is common knowledge that police often use third degree methods during investigation. There is also allegation that they try to suppress truth and put forward falsehood before court for reasons such as corruption extraneous influences political or otherwise. In many parts of our country scientific tests are much more popular than traditional way of investigation. But in other hand, it was also seen that police are not well trained in this field. Unless the basic problem of strengthening the foundation is solved the guilty continue to escape conviction and sometimes even innocent person may get implicated and punished. It is therefore necessary to address ourselves to the problems and strengthen the investigating agency.

VI. JUDICIAL INTERPRETATION

Scientific criminal investigation has revolutionized the criminal justice system by shifting the focus from confession-based policing to evidence-based adjudication. Techniques such as DNA profiling, fingerprint analysis, forensic pathology, cyber forensics, ballistic science, and digital surveillance have enhanced the precision and objectivity of crime detection. These methods not only improve conviction rates but also reduce the risk of wrongful prosecution.

Judicial decisions in India have shaped the constitutional boundaries of scientific investigation. In *State of Bombay v. Kathi Kalu Oghad* (1961)²², the Supreme Court held that collecting fingerprints and handwriting samples does not violate the right against self-incrimination, thereby legitimizing forensic identification. Similarly, in *Ritesh Sinha v. State of Uttar Pradesh* (2019)²³, the Court authorized the collection of voice samples during investigation, recognizing technological advancement while emphasizing procedural safeguards.

Conversely, in *Selvi v. State of Karnataka* (2010)²⁴, the Supreme Court ruled that involuntary narco-analysis, polygraph, and brain-mapping tests are unconstitutional, as they violate Articles 20(3) and 21. This judgment reinforced the principle that scientific techniques cannot override fundamental rights.

The effectiveness of forensic science in securing convictions was prominently demonstrated in *Mukesh v. State (NCT of Delhi)* (2017)²⁵ (Nirbhaya case), where DNA profiling, medical examination, and call data records were pivotal. Likewise, in *State of Himachal Pradesh v. Rajesh Kumar* (2018)²⁶, the Supreme Court emphasized the reliability of DNA evidence in rape cases, observing that DNA is scientifically accurate and highly probative.

However, investigative lapses undermine scientific credibility. The *Aarushi Talwar* case²⁷ (2017 SC) exposed deficiencies in crime scene preservation and forensic handling, resulting in acquittal due to lack of conclusive evidence. Such instances reveal that scientific tools are only as effective as the procedures governing their collection and analysis.

From a preventive standpoint, the establishment of DNA databases under the Criminal Procedure (Identification) Act, 2022, and the increasing use of biometric systems and cyber-monitoring mechanisms contribute to identifying repeat offenders and predicting crime patterns. Nevertheless, concerns regarding privacy, data protection, and potential misuse necessitate strict regulatory oversight.

In conclusion, scientific criminal investigation is indispensable for modern crime detection and prevention. While technological innovations enhance accuracy and deterrence, their legitimacy depends upon constitutional compliance, proper training, infrastructure development, and ethical accountability. Science strengthens justice only when integrated with due process and the rule of law.

VII. CONCLUSION

Scientific criminal investigation has become an essential pillar of modern crime detection and prevention. Judicial decisions demonstrate that while forensic and technological tools enhance accuracy, reliability, and deterrence, their use must remain firmly grounded in constitutional safeguards and procedural integrity. The true strength of scientific investigation lies not merely in advanced technology, but in its ethical application, proper evidence handling, and respect for fundamental rights. Ultimately, science can significantly strengthen the criminal justice system—provided it operates within the framework of fairness, accountability, and the rule of law.

²² **State of Bombay v. Kathi Kalu Oghad**, AIR 1961 SC 1808

²³ **Ritesh Sinha v. State of Uttar Pradesh**, (2019) 8 SCC 1

²⁴ **Selvi v. State of Karnataka**, AIR 2010 SC 1974

²⁵ **Mukesh v. State (NCT of Delhi)**, (2017) 6 SCC 1

²⁶ **State of Himachal Pradesh v. Rajesh Kumar**, (2018) 2 SCC 69

²⁷ **Nupur Talwar and Anr. v. Central Bureau of Investigation**, 2017 SCC OnLine All 367

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