

# THE CRIMINOLOGY OF THE FUTURE: HOW SCIENCE HELPS TO INVESTIGATE CRIMES?

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## INTRODUCTION

Criminology refers to the scientific study of crime and criminal conduct, additionally it is founded on social, anthropological, economic psychological and other non-legal principles. Criminology study a number of connected topics i.e. the characteristics of those who commit crimes, reasons why people commit crimes, the effect of crimes on people and community, criminal prevention strategies and so on.<sup>1</sup>

Once Maureen Johnson said, “In any investigation, time is what you lack. Evidence disappear one hour at a time. People and the environment can damage crime scene. Things are shuffled, relocated, changed and smeared. Organisms decay. Contaminants and dust are blown by wind. Memories deteriorate with time. You go away from the remedy as you move away from the incident”.

The line from Maureen Johnson’s book, “Truly Devious” cited above may assist readers comprehend the importance of technological advancement in the field of criminal investigation. It can help in situations where a matter cannot be handled precisely and swiftly because there is insufficient evidence, as well as in criminal proceedings. All you require is a strong lead.

Think about a criminal scene. A dead body lay there, things were scattered and there was blood on the ground. A person has been accused of the crime in the interim. He rejects that as well. At this point, several questions start to surface. What could have prompted the defendant to murder the victim? How was he killed by him? Do there exist any evidence linking the accused to the crime itself? What had happened and how was he feeling? Criminology now starts to come into play in figuring out the particular and origins of the crime. On the other hands,

science provides accurate, reliable and unbiased information, helping to connect the dots between the facts and the evidence. As a result, criminal investigation involves both criminology and forensics. It is indisputable that society is undergoing substantial technological change and criminals have improved their hiding techniques in tandem with these advancements. The average individual nowadays also has a better understanding of science and technology because everyone has access to cellphones and the internet. With the internet, finding numerous ways to commit a crime without being caught is simple. Because no information is left behind, using the dark web for unlawful behavior is much more concerning.<sup>ii</sup>

The barrier to crime has been lowered by technological advancements. However the same hand can also be helpful in the investigation into the crime. Among the many concepts that make up forensic science as a tool for better criminal justice and administration are ideas from biology, sociology, criminal psychology, DNA profiling, physics, chemistry, fluid analysis, handwriting analysis and computer science.<sup>iii</sup>

#### **STATEMENT OF PROBLEMS:**

The field of criminology is expanding. The nature and effect of wrongdoing have also changed with advancements and advances in society as a whole. Criminology is a field that must adapt to changing circumstances and modernize its theories and methods in order to be useful in the administration of justice. When properly executed, it would increase the strategies' viability and provide criminologists with additional opportunities. If criminology does not change, it won't be able to keep up with the times and would give into advancements.<sup>iv</sup>

Forensic science which enables law enforcement to accomplish everything from clearly identify a suspect in crime to pinpoint the particular moment and manner of an incidence, is one of the most important elements of any criminal investigation. Forensic science is defined by the National institute of justice as the application of science to legal matters. It can be used to understand blood spatter patterns, match DNA to a specific person and determine the chemical make-up of unidentified medications. Law enforcement may study physical evidence and be confident in practically every decision they make in a criminal case by using forensic science. The result of a forensic test may also be used in court to support evidence accepted into evidence during a trial.<sup>v</sup>

Timely completion of crime investigation has been made possible by the use of science as a fundamental tool. We need a lot of resources to help the investigators come to a decision because we all know that time is of essence in any inquiry while trying to find the ultimate truth. Science is essential in this situation because it expedites the entire investigation process and helps the investigators determine what to do next at every stage. Because we can now employ effective scientific approaches to extract the answers from the crime scene, thus we can assert that science will replace criminology in the future. In this research, we will talk about how science can help in investigating crimes.<sup>vi</sup>

The concept of using forensic science in criminal investigation is comparatively new, emerging. It is a new domain in criminal investigation. It has become a pressing issue in almost all the developed and developing countries worldwide. There is no state who wants to lag behind their perpetrators or offenders. If the scientific inventions and innovations are not being used in effective way, the violence of criminals will be increased and they will be out of hand.

### **RESEARCH QUESTIONS:**

Following questions need to be addressed for the current research-

01. How forensic science works in criminal investigation?
02. What measures can be undertaken to strengthen the investigation process?
03. What are the latest breakthroughs in forensic science?
04. Whether there are sufficient statutory provisions regarding the application of science in criminal investigation or not.

### **HYPOTHESIS:**

If the cause behind crimes and scientific advancement can be coordinated, crosschecked and the laws are upgraded with time, crime can be lessened in the future.

### **RESEARCH OBJECTIVES:**

The objectives of the research are following:

01. To find out the scientific techniques needed to be addressed in order to simplify the criminal investigation process in large number.
02. To suggest some recommendations for formulating better policies through scientific inventions by the state.
03. To explore the gap of insufficient statutory provisions regarding the application of science in criminal investigation.
04. To explain how the various fields of forensic science can play crucial roles in helping criminal investigation.
05. To identify the strengths and weaknesses of use of science in investigating crime.

#### **RESEARCH METHODOLOGY:**

The study's technique will be multidisciplinary in nature. A multidisciplinary approach is used when professionals from more disciplines collaborate on a common project within the confines of their respective disciplines. A trans disciplinary team is an interdisciplinary groups whose member have enough trust and confidence in one another to look beyond the confines of their own fields and take a more comprehensive approach. Only a few of them include discovering a publication venue, trusting research you lack the ability to evaluate yourself, comprehending the concepts underpinning a discipline other than your own a finding a common language to communicate ideas. Interdisciplinary research involves cooperation and teamwork to combine information, approaches, viewpoints and ideas from other fields in order to enhance fundamental knowledge or address pressing issues.

It is necessary for multidisciplinary teams to come together and develop a common language and framework for discovery and innovations in multidisciplinary research, but it is also necessary for individual researcher to develop a deep understanding of two or more disciplines and be fluent in their languages and methodologies, which is more common. Individuals not only learn for themselves but also from one another. Nowadays, multidisciplinary studies are more popular than ever. A study of research is becoming impossible to keep apart from other fields including anthropology, sociology, and psychology.

Multidisciplinary research is a type of inquiry where a problem is researched and a solution is found by combining the resources of several sciences and disciplines. Multidisciplinary research is necessary to handle the majority, if not all, of the important research topics of the upcoming decades. This coordinated investigation is conducted in collaboration with experts from several domains. They pool their collective knowledge to address any problems.<sup>vii</sup>

## **LITERATURE REVIEW:**

The current study denotes the necessity of scientific advancement in investigating crimes. For answering the research question, testing the hypotheses and finding out the research objectives, it is necessary to review relevant literatures to find out the existing gaps that are needed to be filled up. For the purpose of the study books, international journals, reports, blogs etc. have been reviewed. The relevant literatures are discussed below in systematic order-

**Books-** David Weisburd and Anthony Petrosino in their book titled, “Encyclopedia of social measurement” wrote that, when carried out with complete integrity, experiments involving programs, policies or practices are a significant study design in criminology because they offer the most compelling data on the effects of an intervention. Experiments offer greater assurance than other study approaches that all plausible alternate explanations for any observed findings aside from the impact of intervention- have been excluded. Although there has been considerable debate on the use of experimental methods in crime and justice, non-experimental approaches are much more frequently utilized in evaluative research in criminology.<sup>8</sup>

Russil Durrant, Tony Ward in their book, “Evolutionary Criminology” wrote that, by putting out how frequently criminologists have argued that their perspective or approach has been overlooked and deserves more attention we do not want to criticize them, after all we make the same argument for evolutionary explanations in this book. Additionally, the majority of the authors are more than ready to acknowledge the significance and worth of level of analysis other than the ones that support. However, criminologists frequently assert explanatory primacy for the preferred theory or theoretical approach, whether implicitly or overtly. We

believe it is essential to present a clear framework for comprehending how various explanations connect to the another and the phenomena they aim to explain.<sup>viii</sup>

Here in these two books we see the philosophical or psychological aspect of criminals and investigation of crime. But nowhere in these books talk about methodology or future state of criminology rather these don't share any techniques that can be applied in the future.

**Journal Articles:** Police officers can have a normal education, a moderate education or superior possibilities and training experiences. The determinism of criminal investigation and the practical functions of forensic science were two ideas that were supported by 40% of the respondent in a particular survey. The majority's opinion demonstrates the growing appreciation for the value of forensic science. The opinions of forensics are not success related dependencies on criminal investigations, according to 50% of the respondents. These were opinions held by the conventional police mentality which consists of inadequately trained officers with little formal education. The minimal support for forensics potential to aid investigators came from the remaining 10% of the subjects.<sup>x</sup> This article illustrates the responses and portrays the real scenario of the efficiency of police officers in forensic science related investigations but India's one provincial state, Sindh only. We do not see this sort of practical responses in every police department.

The critical outcome metrics in Jones and Weatherburn's (2004) review of a forensic operation to enhance crime scene attendance in Australia did not change as expected by those in charge of the operation. The results showed no rise in the arrest rate for either of the target offences in relation to the total number of crimes or in absolute terms in the three intervention zones. The failure to significantly raise forensic identification rates was blamed for the decrease in arrest rates. This in turn was affected in part by the decision not to expand the quantity of forensic evidence gathered. Only one of the three target areas' fingerprint collection rates for breaking and entering experienced statistically significant increases.<sup>ix</sup> The journal shows the issue concerned with Australia only. Australia as a developed country they did not even able to formulate innovative scientific policies. Then it is a greater concern for the least developed states. This article does not talk anything regarding those countries and what initiatives must be undertaken.

**Website blogs:** Many variables were taken into account when choosing which technology needs to be included to foster the criminal investigation process. We considered things like the topic's relevance to forensic technology, the field's novelty, the technology's dependability etc. Biosensors for fingerprint analysis, immunochromatography, and DNA phenotyping using stable water isotopes to locate a culprit or victim. The most recent developments in forensic science technologies including forensic palynology, block chain based solutions, cloud forensics, digital vehicle forensics, social network forensics, 3D technology to assess physical fitness, drone forensics etc. In addition, many other technologies existed before 2021, including forensic Carbon 14 dating, magnetic fingerprinting, automated fingerprint identification, high-speed ballistics photography, and alternative light photography, video spectral comparison, digital surveillance for Xbox, and 3D forensic facial reconstruction. Criminal investigations have made use of cutting-edge technologies.<sup>x</sup>

During a criminal investigation, forensic scientists are entrusted with gathering data and evidence from crime scenes in order to provide a comprehensive description of how the crime was committed. How skillfully this inquiry is conducted has an Impact on the number of convictions and our understanding of a crime. Importantly science and technology have the potential to make that goal easier and more effective. The preservation of bone proteins, an easier way to view fingerprints, the actual potentials of proteomes of forensic science and portable equipment that can rapidly identify substances are four technological advancements that are regarded as fundamentally altering the course of criminal investigations.<sup>xi</sup> Undoubtedly these scientific innovations will help in criminal investigation to a greatest extent in future, problem is these techniques are not merged and added with legal provisions yet particularly in statutory laws. We don't even find this in international instruments. If there is no legal or evidentiary value of these in the investigation, then they will be of no use.

### **Case decisions:**

*Tandoor murder case (1995) Delhi:* This was the first criminal case that forensics had ever helped to solve in India. Susie Sharma shot his wife dead in this case because he thought she

was having an adulterous affair with Matloob Karim, her classmate. After doing the immoral act, he drove her body to the Bagiya restaurant where he and the manager Keshab Kumar tried to burn her in a tandoor. Police discovered Sharma's gun and sent it and his blood-stained clothing to the forensic lab on Lodhi road. Sahni's parents Harbajhan Singh and Jaswant Kaur were also transferred to Hyderabad for a DNA test and their blood was drawn.

Test results the DNA report, which established beyond a reasonable doubt that the burned body belonged to Sushil Sharma's wife Naina Sahni, the testing has proven this according to Mr. Harbajhan Singh and Jaswant Kaur's biological kid. Finally forensic evidence was used to find Mr. Sushil Sharma's guilt. <sup>xii</sup>

*Sister Abhaya murder case (1995) Kerala:* On March 27, 1992 a Roman Catholic nun named Sister Abhaya was found decomposing in a well at St. Pius X Monastery in India. Several scientific techniques such as narco-analysis, brain mapping and polygraphic testing were used to solve this case's puzzle during the inquiry and the two priests were ultimately found responsible for Sister Abhaya's rape and death. <sup>xiii</sup>

There are not enough cases reported in other states except India. We need uniform rules and regulations in every state keeping in mind the resource and capacity of the states.

### **SCOPE AND LIMITATION:**

The discipline of forensic science is so vast and varied that it is currently a necessary workhorse for the administration of criminal justice. The current state of criminal investigation and prosecution in most of the countries is grim. In the Indian sub-continent countries like India, Bangladesh, Pakistan etc. s significant portion of trials results in acquittal. Both official and unofficial statistics are available for it. When it comes to the official statistics it is about 90% and the unofficial rate is considerably higher. Criminal investigations and punishments of offenders fall short of expectations. Even in shocking crimes a hefty proportion of criminals were unable to be brought to justice and a small percentage of cases results in acquittal which



leads to progressive increase in both the number of offenders and the severity of the crimes. These recurrent acquittals are primarily the result of out-of-date investigational practices that created a number of ambiguities. Therefore, scientific methods of research are absolutely essential for actual investigations.

As far as the limitation is concerned, access to insufficient literature is the prime limitation in this research. As this is comparatively a new topic to look on, there are not adequate research materials on and off the internet. Not all books have e-book version. Not everyone has access to all the books and journals as well. Besides there were no newspaper articles, landmark case decisions and other sources. With the passage of time, this needs to be updated. Furthermore, as it is not an empirical research, no field study and interviews were conducted.

#### **SIGNIFICANCE AND CONTRIBUTION:**

This research is an attempt to bring to light the scientific inventions and apply those concurrently in criminal investigation. In order to pinpoint the particular and causes of the crime, Criminology first enters the picture. On the other hands, science provides accurate, reliable and unbiased information, helping to connect the dots between the facts and the evidence.

As a result, criminal investigation involves both criminology and forensics. The actual significance is the importance of applying in the real world scenario. As there is insufficient number of research held in this area I believe this research will set a new dimension having a positive impact in the society.

The research will have a knowledge based contribution towards legal and science based departments. The findings of the research will help the policymakers and states to develop further strategies to ensure the adequate use of science in criminal investigation.

## **BANGLADESH'S CURRENT LEGAL FRAMEWORK FOR USING FORENSIC EVIDENCE IN THE CRIMINAL JUSTICE SYSTEM**

A criminal case is filed followed by an investigation, an arrest, the formulation of charges, the conclusion of the trial and a conviction or acquittal where forensic evidence can significantly advance the case. In our nation, criminal justice system participants like Attorneys, Detectives, and even Judges lack the training necessary to effectively employ forensic scientific information. Given the volume of cases pending in court and the conviction rate, a solid legal and institutional framework is now necessary to ensure the use of forensic evidence in the criminal justice system. The time of the trial could be shortened by enhancing the forensic evidence's capacity to quicken criminal processes in Bangladesh. When a criminal case is over, this will significantly enhance the rate of conviction or acquittal, ensuring that the people receive justice. This is a modest attempt to assess Bangladesh's current legal framework and the organizations collaborating with the criminal justice system to determine the range of forensic evidence.

According to a general definition, forensic science is a branch of science that uses natural science methods and principles to identify, classify, and evaluate physical evidence in order to administer justice. And the scientific evidence is proof that was produced using scientific methods or understanding. Scientific knowledge is founded on information that has been acquired by scientific means. This indicates that the evidence's underlying premise has undergone testing and general acceptance among scientists. This could imply that the theory, which is supported by empirical data, has been published in academic publications and has undergone peer review within the scientific community. The majority of forensic evidence is scientific, including genetic evidence.

I'll try to briefly summarize Bangladesh's current legal framework for using forensic evidence in the criminal justice system below. Bangladesh currently has the following laws: Criminal Procedure Code, 1898, Evidence Act, 1872, The International Crimes (Tribunals) Act, 1973, The Narcotic Control Act, 1990, Digital Security Act, 2018, Deoxyribonucleic Acid (DNA) Act, 2014, Consumer Protection Act, 2009, Food Safety Act, 2013.

*The laws are explained below-*

**Criminal Procedure Code, 1898-** A civil surgeon or other medical witness' testimony may be considered at any time throughout the trial or other phases of a criminal case as per section 509 of CrPC. After technically assessing the situation, a medical witness or someone with particular expertise of medical science must provide their testimony. A post-mortem report prepared by a civil surgeon or medical officer may be used as evidence at any stage of the criminal proceedings, according to Criminal Procedure Code Section 509A, even if the examining physician is unable to testify in person. The doctor's testimony in court will be acceptable as proof, true or untrue. According to Section 174 of the Criminal Procedure Code, forensic pathology or forensic medicine cases need an investigation and an autopsy. It has the authority to direct a magistrate or trial court to dismember or exhume a corpse from a grave in accordance with forensic evidence under Section 176 (2) of the Code of Criminal Procedure. The court has discretion to accept the findings of forensic chemists, ballistic experts, and serologists designated by the government without their presence, according to Section 510 of the Criminal Procedure Code. The process for an insane person's trial is governed by sections 84 of the Penal Code and 464 of the Criminal Procedure Code. The court will be assisted in this by forensic psychology and psychiatry.

**Evidence Act, 1872-** If a witness has expertise in foreign law, science, art, handwriting analysis, or fingerprint identification, their testimony—which is not typically admissible under the terms of Section 45 of this Act—may be used as evidence. The principal Bangladeshi regulation governing the use of forensic evidence in criminal proceedings is this part. This part allows an expert to evaluate specific forensic evidence types, present the results of that investigation in court, and have the evidence admitted into evidence. The Evidence Act's Section 45 addresses forensic techniques, fingerprints, and handwriting.

**The International Crimes (Tribunals) Act, 1973-** According to Section 19 of the Act, the tribunal may use any forensic evidence to support its arguments. The emphasis in law is on forensic evidence. For the purpose of conducting a trial under this Act, the tribunal has the authority to consider any evidence, including forensic evidence. The provisions of this statute

are not exclusive to the International Criminal Tribunal, despite the fact that it was adopted specifically for the trial of international crimes.

**The Narcotics Control Act, 1990-** According to Section 50 of the Act, the government must establish chemical laboratories for testing chemicals in accordance with this Act and select chemical experts for this function. This section's chemical test reports are all forensic evidence. Any chemical report created in accordance with this section is admissible as evidence in any proceedings or investigations conducted in accordance with this Act. However, due to the fact that this Act is a unique type of law created for a particular purpose, its provisions are only applicable to the actions carried out under this Act.

**Digital Security Act, 2018-** To fulfill the Act's goals, Section 10 of the Act gives the Government the authority to establish one or more digital forensic labs. These labs must be governed by the Digital Security Agency, which was established under Section 5 of the Act. This Act permits the creation of regulations governing the use and operation of laboratories. This provision states that any other laboratory set up by the government prior to the passage of this Act may be used for this Act. According to Section 11 of the Act, the corporation is responsible for ensuring that each digital forensic lab meets the requirements set forth in this rule.

In accordance with the Sec 51 of the Act the Tribunal or Appellate Tribunal shall in the course of the proceedings get an independent opinion from experts in Computer science, cyber forensics, electronic communications, data security, and other related fields. The Govt. or organization shall give particular training in Computer Science, cyber forensics, electronic communications, data security, and other related fields to all persons engaged in the implementation of this law.

**Deoxyribonucleic Acid (DNA) Act, 2014-** This law was enacted with the purpose of gathering and assessing DNA evidence for the first time in Bangladesh. The creation of a national DNA database and the collection and testing of DNA samples are both covered by the DNA Act. It is what might be referred to as forensic evidence. According to Section 4 of the Act, a police officer conducting an investigation may request a DNA sample from a suspect or an accuser. Ask the suspect's legal guardian to submit the sample if the suspect is a minor or has a physical

or mental impairment. Article 5 Keep in mind that if anything is discovered, DNA samples must be taken from the crime site. Furthermore, according to section 6, no DNA sample may be taken without at least two witnesses, the suspect's written consent, or the approval of his legal guardian. According to Section 7, if a request made under Section 4 is not accepted within three hours, it will be presumed that the requestor is unwilling to submit the sample, and in this case, the request will be treated as a record in the manner provided. After giving both sides a fair chance to be heard, the court may mandate the collection of DNA samples from the suspect or accused, according to Section 8. According to Section 37, DNA reports submitted in accordance with this section may be used as proof in any proceeding. All criminal procedures are subject to the provisions of this Act.

**The Consumer Rights Protection Act, 2009-** Sections 42 and 62 deal with the procedure for gathering and delivering food samples to a lab for adulterant testing. According to Section 62 of the Act, the Magistrate must conduct a thorough analysis and investigation of the product in question if he believes that doing so will make it impossible to determine whether the claim of a product defect is true. To check for the presence of any defects, samples of that product should be sent to any appropriate laboratory with the relevant instructions. Within 2 (two) months of the date the test report was submitted, the product report that was delivered to the lab for testing must be presented to the magistrate's court. This method will also be taken into account as forensic evidence.

**Food safety Act, 2013-** Additionally forensic evidence is used in this law. For instance, Sec 50 of the Act stipulates that a court may issue a self-imposed order for food testing if a judicial proceeding involving this Act is continuing. In accordance with sec 73 of the Act, if a complaint is filed under this Act and an examination is required to ascertain the authenticity of the food, the court shall order the collection of samples and send them for testing. The report must be produced within a month of sending the sample for testing.<sup>xiv</sup>

## **MODERN FORENSIC SCIENCE TECHNOLOGIES THAT CAN HELP IN CRIMINAL INVESTIGATION**

Since technology affects every aspects of our lives, it makes sense that crime solving methods have improved to the point that they are almost futuristic. From retinal scanning to trace evidence chemistry, actual forensic technology is so far advanced in helping to solve crimes that it resembles something from a science fiction film. This sector is one of the fastest growing in the USA given the state of forensic technology. One sign of this is the increase in demand for forensic science technicians. According to the Bureau of Labor Statistics, 2021 employment of forensic science technicians will increase by 16% in 2020 to 2030. During a criminal investigation, forensic scientists are entrusted with gathering data and evidence from crime scenes in order to provide a comprehensive description of how the crime was committed. The amount of convictions and our understanding of a crime are both impacted by how thoroughly these investigations are conducted. Importantly, scientific and technological advancements have the ability to make that objective simpler and more successful. Here are a few cutting-edge forensic methods that you probably were not familiar with.

By comparing samples, DNA can be used to identify a suspects' physical characteristics as well as to match DNA taken from a crime scene to a suspect. In DNA, there are 23 chromosomes that code for appearance. Detectives can determine a suspect's distinctive features such as hair, eye and skin color by sequencing a DNA sample with the aid of forensic specialists. Newer techniques can also determine age and biological background. This is called DNA phenotyping.

Similar to DNA, a suspect's fingerprints can be matched to those found at a crime scene by comparing them. However, not all fingerprints are distinct or readable. In order to identify the suspect forensic scientists can now employ biosensors to examine the minute amounts of biological fluids found in fingerprints. Age, medication use, gender, and lifestyles are all variables that can be identified. The use of biosensors on other bodily fluids discovered at a crime scene is also possible. That is Biosensors for fingerprint sensors.

**Immunochromatography** is a method for identifying the diseases that involves in applying a little sample to a pre-made test-strip. Covid-19, HIV, and even pregnancy testing often use this technique and results are typically available fairly rapidly. In forensics, Immunochromatography tests are used to find substances in patient's bodily fluids such as drugs and medications. Even a smartphone based sensor has been developed to use this test to examine spit samples outside of a lab setting.

**Stable water isotopes** can be used to geolocate a suspect or victim since they differ from one atom to the next and have a different personality. According to recent forensic studies, scientists can determine the source of a water sample taken from a suspect or victim by separating the isotopes from the sample. If enough samples are available, the isotopes can even duplicate the subject's path. Different isotopes detection techniques can be used to count the number of people present.

**Forensic Palynology** is relatively a new field for the scientists. It is the study of pollen, spores, grains and seeds and it is used in forensics to determine a subject's location. Small pollen grains and spores can very subtly attach to skin and clothing. The means for gathering, contrasting, and using these trace components as evidence have not yet been developed by Scientists.

Today cloud storage or distant servers are used to store more than 50% of all personal and business data. As a result, digital forensic scientists have had to create methods for acquiring, looking through and evaluating material that has been obtained from the cloud. When managing this data, numerous security and privacy issues come up. Since block chain technology is so difficult to manipulate, digital forensic experts have started employing it to help protect the integrity of the data and build a custody chain. That is block chain based solutions- Cloud forensics.

In the field of automobile forensics, tangible evidence including fingerprints, fluid samples and trace materials like soil are frequently collected by investigators. They can also physically inspect the car to determine how a car or terrorist attack occurred. Digital vehicle forensics which has emerged as a result of automobiles becoming more technologically savvy, may now

be used by scientists and investigators to collect information such as recent destinations, frequent routes, personal information and favored sites.

Social network users will increase from the present amount of more than 3.6 billion to 4.5 billion by 2025. When social media first gained popularity, there was less material for detectives and forensic scientists to sort through. A given topic's social media data can now be inundating. To help in the evaluation of this data, scientists have lately developed models for evaluating the data obtained from social networks. To be accepted in court, automated data analysis must be based on repeatable, comprehensible and testable modes. This is Social network forensics.

*3D Technology to determine physically fit:* Forensic scientists frequently need to put the physical evidence back together. It is common practice to employ technique called as physical fit to determine the origin of two parts. These pieces of evidence can be made of a broad variety of materials and typically they are brittle artifacts like bones. In a recent study at the University of Portsmouth, the precise measurements of some charred bones were mapped using 3D imaging and the fragments were then rebuilt using a 3D printer. In order to check whether or not the parts fit together, they were forbidden from handling the fragile evidence too much. This is called 3D technology to determine physically fit.

*Drone Forensics:* As of August 2021 there were more than 880,000 drones registered with the FAA in the USA. More than 40% of those drones have been registered for business purpose. Criminals now have a new method for victim attacks, unauthorized monitoring and narcotics smuggling thanks to their growing popularity. Forensic scientists are collecting and analyzing data from the drones, SD Cards and mobile devices utilizing techniques and models. This is Drone Forensics. <sup>xv</sup>

## **FORENSIC SCIENCE IN CRIMINAL JUSTICE SYSTEM**

The most important factor in a criminal case's outcome in both the pre-trial and trial phases is forensic science. For instance, chemical analysis and doctor reports are crucial for determining



guilt in cases of injury, rape, death, and acid throwing. In fact, some criminal cases involving murder, suicide, and rape involve complex medico-legal issues. Forensic science is crucial to these cases at every stage of the investigation and trial process, from managing the crime scene and conducting an investigation to taking depositions and evaluating the evidence before going to court. The inquest report, the autopsy (Post Mortem) report, the viscera test report, and DNA test reports are among the necessary forensic evidence in the trial of murder, suicide, and rape are the autopsy (Post Mortem) report, the DNA test report, the viscera test report, and the inquest report, among other reports. The methods for creating and using the aforementioned reports in court will be determined at this point, and the impact of incorrect forensic reports on the aforementioned instances will be investigated.

*Inquest report-* One of the requirements for a post-mortem examination of a deceased body is an inquest report, also known as a surat hal report. An inquest is an investigation into the apparent cause of deaths of the kind covered by sections 174 and 176 of the Code of Criminal Procedure carried out by an Investigating Officer (IO). Suicidal, homicidal, accidental, and suspicious deaths must be investigated in an inquest, according to Section 174, whereas custodial deaths must be investigated at an inquest, according to Section 176.

According to the ruling in *State of U.P vs. Irfan and Others*, the sole goal of compiling an inquest report is to look into and compile a report of the apparent cause of death, describe any wounds that may be visible on the deceased's body, and indicate how, by what weapon, or with what instrument such wounds appear to have been inflicted. Upon obtaining information, the concerned police officer is required to go to the scene of the incident, conduct an investigation, and write a report outlining the current state of the dead body and identifying the apparent cause of death.

The inquest report includes information about the deceased's identity, age, sex, and religion in addition to the location and surroundings of the scene where the body was discovered and a description of the clothing it was wearing. For instance, all of the visible indicators of hanging will be presented in the case of a hanging death. However, as the inquest report is not a statement of any kind wherein all the identities of those accused must be disclosed, there is no

room to discuss the specifics of how the dead was injured, who assaulted him, or in what conditions he was assaulted. Therefore, the law only requires that it be determined whether the person died unexpectedly or under suspicious circumstances if so, what appeared to be the cause. The prosecution may have a key lead to the crime depending on whether all or any of the following are present or absent in an inquest report.

- I. Post mortem hypostasis
- II. The body temperature
- III. The muscle condition

*Post mortem hypostasis:* Post-mortem hypostasis, also known as "post-mortem staining," is the appearance of a bluish-red color on the body's skin when it comes into contact with the ground or a hard object. A body that has been exposed to the cold or kept in the refrigerator may take on a pink color, and a body that has been asphyxiated will develop a deeply bluish-violet or purple color. However, depending on the type of poison employed, this color will differ if poison caused the death. Cherry-red indicates carbon monoxide poisoning, vivid red indicates burns from hydrocyanic acid poisoning, red-brown indicates poisoning from nitrites, potassium chlorate, etc. Within an hour of a death, post-mortem staining starts to develop and becomes clearly visible between four and twelve hours later. Identification of the cause and the time of death will be made easier with the help of the inquest report's description of the aforementioned issues.

*The body temperature:* Following death, the body loses its natural heat through conduction, convection, and radiation, gradually reaching the ambient temperature of its surroundings. After death, the body temperature drops at a rate of 1.50C per hour until it reaches the ambient temperature. This process is an excellent measure of how long a body has been in place and helps determine the approximate time of death. Using a rectal thermometer or obtaining a reading from the liver is the most typical approach to take the body's temperature.

*The muscle condition:* By describing the changes in the deceased body's muscles that occur three days after death, the inquest report helps to determine the approximate time of death. The body's muscles go through three stages of relaxation after death, for example: a) immediately

following death, the muscular system starts to relax; this is known as the primary relaxation. The typical time for this stage is two to three hours; b) after this, rigor mortis sets in, during which the body loses the ability to contract; this stage lasts for two to three days; and c) when rigor mortis has passed, the muscles once more become soft and flaccid and start to degrade. The inquest report's mention of the aforementioned alterations will aid in determining the time of death. In actuality, a lot of investigating officers ignore the aforementioned issues and add pointless and irrelevant details to the inquest report. This technique not only affects the autopsy report but also lessens the prospects of justice being served since although if the inquest report is not a substantial piece of evidence, it is a crucial foundation for establishing when the crime was committed. Consequently, a flawed inquest report could undermine the prosecution's case.

## **FINDINGS AND RECOMMENDATIONS**

The aforementioned discussions clearly demonstrated how important forensic science is to the current criminal justice system. In reality, it is almost impossible to conclude an inquiry into a crime, such as a rape, murder, suicide, or other type of crime, without using forensic science.

Due to a lack of a legal framework and deficiencies in Bangladesh's current procedural laws governing criminal justice, forensic science cannot be used. Therefore, a thorough legal framework will need to be established, either by passing new legislation or making the required changes to the current laws, in order to fully utilize forensic science in the investigation and prosecution of criminal offenses.

The procedural issue in presenting forensic evidence to courts is one of the major barriers. With a few exceptions, the forensic expert in question must come before the court and submit to the same types of interrogations that a regular witness would. Such a procedure dissuades professionals from participating in the procedure of gathering and comparing samples in order to prepare a forensic report. Additionally, taking advantage of the adversarial system, the lawyers ask the experts irrelevant questions, which unexpectedly delays the hearings.

Police have the sole authority to conduct criminal investigations. According to the legislation, they must look into a sudden, violent, and suspicious death in order to write an inquest report.

The investigation officer must also determine whether to send the body to a civil surgeon for a medical examination. The majority of police officers, however, do not possess the necessary knowledge to describe the many injuries that are visible on the body, even those that occurred after death. Coroner System or a medical examination system should be implemented to address this issue.

To guarantee a high standard of medico-legal inquiry, police, judges, magistrates, attorneys, and forensic professionals should coordinate. To achieve this, it should be mandatory for newly hired police officers, judges, and attorneys to complete a six-month intensive training program before enrolling in the Bangladesh Bar Council.

Our law schools' curricula are not created using an interdisciplinary approach. Few public and private universities that provide undergraduate and graduate programs in law incorporate forensic science in their curricula, making it practically unknown in contemporary legal education.

The probability of receiving justice is reduced due to the physical evidence being damaged when the courts reject the forensic report as being false and contrived, which not only lengthens the trial but also causes it to drag on. It is because the current legal framework does not offer enough guidelines for the gathering and preservation of forensic evidence.<sup>xvi</sup>

## **CONCLUDING REMARKS**

According to the aforementioned information, it can be inferred that forensic science is an investigative method that makes use of cutting-edge tools like DNA testing, fingerprint profiling, and narcotics testing to determine the specifics of a crime and a suspect. It was discovered that various nations, including Canada, the US, and Australia, have embraced forensic science investigative technology in the examination of crime and the discovery of evidence against offenders in criminal and civil proceedings. To build databases and conduct criminal investigations, the governing bodies of several nations have also formed forensic science organizations including the Automated Fingerprint Identification System (AFIS), Combined DNA Index System (CODIS), and National DNA Index System (NDIS).

Additionally, it was discovered that the Supreme Court of India's legal protections for individual rights declare a person innocent until and unless proven guilty by a court of law. Criminal law also presupposes that a person must be treated as innocent unless the law establishes that they have committed a crime. Thus, in order to ensure swift progress, the government must encourage scientific knowledge, humanism, and research many fields. The study of the aforementioned presentation amply demonstrates the benefit of forensic science in the swift delivery of justice. A process based on evidence, forensic science integrates various scientific fields. It consists of cutting-edge, modern medical technologies. Forensics demands a specialist who can gather biological samples while taking the necessary safety procedures, such as correct handling and storage of biological samples including blood, semen, saliva, and hair, among others. If the aforementioned measures are taken into consideration for proper and efficient application, forensic science can significantly contribute to obtaining immediate justice for the modern society. The society will surely receive the outstanding reports from the forensic scientists it has hoped for. It is currently impossible to solve a crime without using a new scientific methodology since criminals are utilizing cutting-edge, complex methods to commit their crimes. Because of this, forensic science is becoming increasingly important nowadays. Thanks to forensic science and its cutting-edge procedures, mystery crimes can now be quickly and simply solved. The application of forensic science is expanding all the time. There are many forensic science subfields that are extremely beneficial for crime scene investigation, crime detection, and criminal identification. In forensic science, technological advancement is still possible. Criminal law experts who can secure evidence collection are also required. Compared to the USA, England, and other developing countries, the countries of Indian Sub-continent uses DNA technology very infrequently. In order for the prosecution to persuade the court that the physical sample had an uninterrupted chain of custody from the time of seizure to the time of analysis, accurate proper collection and storage and documentation of the DNA evidence are always required.<sup>xvii</sup>

**ENDNOTES**

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<sup>ii</sup> 'The Criminology Of The Future: How Science Helps In Crime Investigation' (*lawyersclubindia*, 2022) <<https://www.lawyersclubindia.com/articles/the-criminology-of-the-future-how-science-helps-in-crimeinvestigation-13815.asp>> accessed 25 September 2022.

<sup>iii</sup> *Ibid*

<sup>iv</sup> 'Evolution And The Future Of Criminology - Ipleaders' (*iPleaders*, 2022) <<https://blog.ipleaders.in/evolutionfuture-criminology/>> accessed 25 September 2022.

<sup>v</sup> 'How Forensic Science Is Used In A Criminal Investigation | Orlando Criminal Defense Lawyer' (*The Baez Law Firm*, 2022) <<https://www.baezlawfirm.com/understanding-how-forensic-science-is-used-in-a-criminal-investigation/>> accessed 26 September 2022.

<sup>vi</sup> 'The Criminology Of The Future: How Science Helps Us To Investigate Crimes – Legal 60' (*Legal60.com*, 2022) <<https://legal60.com/the-criminology-of-the-future-how-science-helps-us-to-investigate-crimes/>> accessed 26 September 2022.

<sup>vii</sup> (2022) <<https://www.lawctopus.com/academike/multidisciplinary-research/>> accessed 26 September 2022. <sup>8</sup> David Weisburd and Anthony Petrosino, 'Experiments, Criminology' (2022).

<sup>viii</sup> 'Evolutionary Criminology | Sciencedirect' (*Sciencedirect.com*, 2022) <<https://www.sciencedirect.com/book/9780123979377/evolutionary-criminology>> accessed 27 September 2022  
<sup>10</sup>(2022)<<https://www.researchgate.net/publication/296803235>  
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<sup>ix</sup> (*Assets.publishing.service.gov.uk*, 2022) <[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/115849/ho-or4305.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/115849/ho-or4305.pdf)> accessed 27 September 2022.

<sup>x</sup> '10 Modern Forensic Technologies Used Today - Forensics Colleges' (*Forensics Colleges*, 2022) <<https://www.forensicscolleges.com/blog/resources/10-modern-forensic-science-technologies>> accessed 27 September 2022.

<sup>xi</sup> (2022) <<https://www.openaccessgovernment.org/advances-in-forensic-science-criminalinvestigations/134276/>> accessed 27 September 2022.

<sup>xii</sup> 'The Tandoor Murder' (*The Last Word*, 2022) <<https://rudrajyotinathray.com/2014/12/22/the-tandoor-murder/>> accessed 27 September 2022.

<sup>xiii</sup> (2022) <<https://indiankanoon.org/doc/1799988/>> accessed 27 September 2022.

<sup>xiv</sup> <http://lawyersclubbangladesh.com/en/2021/12/07/legal-framework-for-introducing-forensic-evidence-in-the-criminal-courts-of-bangladesh/>

<sup>xv</sup> <https://www.forensicscolleges.com/blog/resources/10-modern-forensic-science-technologies>

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<sup>xvii</sup> [http://www.ijarse.com/images/fullpdf/1523436914\\_JK1433IJARSE.pdf](http://www.ijarse.com/images/fullpdf/1523436914_JK1433IJARSE.pdf)

