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Growing Angles in Forensic Science

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ABSTRACT

Forensic science, the application of the methods of the natural and physical sciences to matters of criminal and civil law. Forensic science can be involved not only in investigation and prosecution of crimes such as rape, murder, and drug trafficking but also in matters in which a crime has not been committed but in which someone is charged with a civil wrong, such as wilful pollution of air or water or causing industrial injuries. It is derived from the latin word "forensis" which means before the forum which is twisted and crooked. It is a scientific methods of solving crimes, involving examining the objects or substances thatare involved in the crime and law is considered as an arts and science and all the subjects in the world which each and everyone is trying to study.

I. INTRODUCTION

Forensic science, the application of the methods of the natural and physical sciences to matters of criminal and civil law. Forensic science can be involved not only in the investigation and prosecution of crimes such as rape, murder, and drug trafficking but also in matters in which a crime has not been committed but in which someone is charged with a civil wrong, such as wilful pollution of air or water or causing industrial injuries. It is derived from the Latin word "forensis" which means before the forum, which is twisted and crooked. It is a scientific method of solving crimes, involving examining the objects or substances that are involved in the crime and law is considered an art and science and all the subjects in the world which each and everyone is trying to study.

II. DIVERSE EXPOSURE IN FORENSIC

1. Computational Forensics

Modern crime investigation leverages the hybrid intelligence of humans and machines. More specifically, computer software and tools allow forensic practitioners to:

- Search large amounts of data efficiently
- Reveal trace evidence for further investigation
- Examine evidence in an objective and reproducible way

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- Evaluate the quality of the examination technique
- Visualize and document the result of the investigation
- Reveal hidden or previously unknown patterns

During the whole process, a broad range of substances, objects, and processes are examined. They are based on pattern evidence, such as shoeprints and tool marks, as well as physiological and behavioural patterns.

Application of Computer animation (for example, audio-visual reconstruction of incidents to aid investigators) in courtrooms is becoming more popular these days.

2. Forensic Astronomy

Astronomy is used (although relatively rarely) in forensic science to determine the sky's appearance at certain times in the past. Moon's or Sun's location in the sky at specific times may legally relevant, such as figuring out the date on which an image was clicked. It is mostly used to resolve issues in art history and other historical problems.

One of the leading experts in the field, Dr. Don Olson, an astrophysicist at Texas State University, has developed special computer programs that map ancient star charts with historical records, photos, weather charts, and tidal patterns. Using these computer tools, he has solved several fine arts puzzles from the past.

3. Forensic Geology

Geology is the science of Earth: it deals with the dynamics and physical history of the Earth, as well as chemical and biological changes that our planet has undergone or is undergoing. Forensic geology address the legal aspects and ramifications of the analysis of the Earth processes and materials.

The use of geological evidence in crime investigation originated with the fictional detective, Sherlock Holmes, in the late 1980s. However, the first real-world use of forensic geology doesn't appear to have occurred until 1904, when German chemist Georg Popp identified a murder suspect from a handkerchief that contained traces of coal dust and the mineral hornblende.

Today, forensic geologists combine science, technology, efficient methods, and personal experience to solve issues involving soil, surface water, groundwater, and anything beneath the Earth's surface. They use various instruments and techniques, such as scanning electron microscopes, X-ray diffraction, and micro chemical analysis.

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4. Forensic Seismology

In this field, various methods of seismology are used to detect and examine underground explosions, especially nuclear explosions. It plays a crucial role in the enforcement of bans on nuclear weapons.

Forensic seismology can also detect other underground events such as explosion within submarines, the movement/collision of icebergs, or massive ocean waves.

In order to accurately identify and spot detonations, a network of about 170 seismic stations is used. These stations capture underground pressure (P) waves and send this signal for processing over a secure communication channel. Special software programs then isolate patterns, eliminate noise, and calculate the explosive yield and depth of burial.

5. Digital Forensics

Digital forensics is a science of finding evidence from digital devices. The technical aspect of an investigation can be split into several sub-fields based on the type of digital equipment involved: computer forensics, mobile device forensics, network forensics, forensic data analysis.

There are five key processes in digital forensics:

1. Identification: Find the evidence, noting where it is stored.
2. Preservation: Isolate, secure, and preserve data so no one can tamper with the evidence.
3. Analysis: Reconstruct chunks of data and draw conclusions based on the extracted information.
4. Documentation: Create records of all data so it can be used to recreate the crime incident.
5. Presentation: Summarize data in a way that it can be easily understood and presented/accepted in a court of law.

However, there is one major limitation in a digital forensic investigation: the use of encryption. It disrupts the initial analysis where pertinent evidence might be located. Laws to make people and companies disclose encryption keys are still relatively new and controversial.

6. Forensic Art

Despite several advances in high-tech investigative tools, a simple pencil sketch can have a substantial impact on civil or criminal cases. These sketches are used in the identification, apprehension, and conviction of a wanted person.

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Typically, forensic artists create such images using crime scene evidence, skeletal remains, or eyewitness accounts. They work closely with law enforcement officers to identify victims and criminal suspects through facial composite sketches.

The three key disciplines in the forensic art field are:

1. Composite Art: involves sketching an unknown subject using a number of individually described parts. A final image is intended to be a likeness or similarity of a witness's perception of the subject.

2. Image Modification: is the process of altering or enhancing photographs in order to help an investigator. Examples of this include age progression/regression or clarifying the CCTV footage to recognize a person.

3. Post-Mortem and Facial Reconstruction: involves rebuilding the facial features of either partially or fully decomposed human remains. Artists can draw or use digital software to produce 3D clay figures.

7. Forensic Entomology

Although forensic entomology is mainly associated with death investigations, it can also be used to detect poisons and drugs, determine the time of the infliction of wounds, and find the location of an incident.

Right from the early phases, insects are attracted to the decomposing body and often lay eggs in it. Forensic scientists can analyze the population of insects as well as the developing larval stages to figure out the postmodern index, any alteration in the corpse position, and the cause of death.

The forensic entomology field can be further split into three categories:

1. Urban: It usually focuses on pests infestations that are related to litigation, such as legal disputes between landlords and exterminators.
2. Stored-product: It involves cases of insect infestation or contamination of commercially distributed foods with the purpose of finding evidence relevant for litigation.
3. Medico-legal: It involves gathering evidence through the examination of insects and other arthropods at a crime scene.

The most frequently studied insects include flies, beetles, scorpion flies, mites, ants, and bees, which are often found in (or near) the body. Investigators also analyze other factors such as location, weather, and geography of the crime scene to determine the time of death.

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8. Bloodstain Pattern Analysis

The use of bloodstains as evidence is not something new. Since the 1960s, trained bloodstain pattern analysts have been using physics (fluid dynamics), biology, and mathematical calculations to accurately reconstruct events at the crime scene.

Analysts categorize the stains by collecting information from splash patterns, transfers, voids, and other marks. Usually, they look for

- Distance from the blood source to the target
- Nature of the force that caused the bloodshed
- Direction of travel and impact angles
- Objects that caused the bloodshed
- Sequencing of two or more bloodshed events

Sometimes, specifically developed software, such as HemoSpat, is used to calculate the area-of-origin of impact patterns. The software can also measure the impacts on non-orthogonal surfaces and show results from various angles.

9. Forensic Chemistry

Forensic chemistry involves the analysis of non-biological trace evidence obtained from crime scenes. The chemist matches samples to known substances, determines the chemical makeup of the material, and discovers where it came from.

Forensic chemists spend most of their time in the lab, analyzing the evidence. They use a wide range of techniques and instruments to identify unknown substances. The two most common methods are:

1. Spectroscopy: Science of measuring spectra produced when materials interact with or emit electromagnetic radiation.
2. Chromatography: An analytical method for separating a mixture of chemical substance into its individual components so that those components can be thoroughly examined.

Specialists mostly use gas chromatography-mass spectrometry, thin-layer chromatography, Fourier transform infrared spectroscopy, atomic absorption spectroscopy, and high-performance liquid chromatography.

During the whole process, they follow a set of predefined rules proposed by specific agencies and governing bodies. These rules ensure the quality assurance and quality control of methodologies and instruments used in the process.

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10. Election Forensics

The consequences of electoral fraud are grave for democratic stability and quality. That's why effective techniques are required to identify and investigate fraud in elections.

Election forensic utilizes various quantitative methodologies to verify that observed election results do not differ from normal occurring patterns. These methodologies can be simple (such as using Benford's law to evaluate the deviation or conformance of vote counts) or can be more complicated and involve machine learning methods.

The latter provides algorithms and tools that look for abstract patterns in data. For example, by using both the synthetic data of vote count and the empirical data from controlled scenarios (where fraud has been observed), one can train the algorithm to 'learn' certain regularities present in the data and associate them with the existence of fraudulent manipulation.

11. Forensic engineering

Forensic engineering includes the investigation of structures, materials, or components that fail or do not function properly, causing damage to property or personal injury. This field also deals with retracing faulty mechanisms that lead to mishaps.

Typically, the aim of forensic engineering is to determine the facts of an accident and spot the point of failure with a view to increase longevity and enhance the performance of the component.

To achieve this, engineers mostly used two methods:

1. Fault Tree Analysis: A top-down approach of examining an undesired state of a system. It can be used to perform all kinds of system-level risk assessment process.
2. Failure Mode and Effects Analysis: A systematic, proactive technique for identifying location and causes of failures. It also involves evaluating the relative impact of different failures.

Airplane crashes, rail accidents, building collapses, heavy machinery failures are usually investigated by forensic engineers. Furthermore, many products have forensic components that monitor signs of early faults to improve efficiencies and quality.

12. Forensic DNA Analysis

DNA evidence alone isn't enough to secure a conviction, but it has become the gold standard in forensic science. It has gotten progressively accurate and faster in the last three decades.

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DNA analysts retrieve data from skin cells left behind on a crime scene and conduct tests in a laboratory with dedicated facilities and devices that meet the FBI's Quality Assurance Standards for Forensic DNA.

The majority of the DNA samples submitted to a lab undergo a sequence of a predefined process, which involves extraction, quantification, amplification, separation, analysis, interpretation of DNA profiles.

Modern data analysis techniques have made it easier to detect and distinguish individuals from a mixed DNA sample. Scientists are currently exploring new DNA methods and user-friendly equipment that could make it possible to run and examine samples in less than two hours.[2]

III. ADMISSIBILITY IN DIFFERENT COURTS

Principles of Scientific Evidence Admitted By United States (Us) Courts

In the past decade, there has been a shift in the admissibility of factual facts in federal courts.[3] Frye v. the United States[4] was the first significant decision in the United States about the enforceability of scientific evidence. The Frye test consisted of two segments. Then, there is the theory or scientific technique, and then there is acceptance. The facets of the test were questioned for two reasons:

1) That there would continue to be a significant time gap before the scientific approach is embraced by the community.
2) That the scientific community is more trusted than the Court of Law. As a result, the Federal Rules of Evidence were adopted in 1975.

As a result, the Federal Rules of Evidence were adopted in 1975. "If science, technological, or other professional expertise will assist the trier of fact in understanding the facts or determining a fact in question, a witness qualified as an expert by knowledge, ability, experience, training, or education can testify thereto in the form of an opinion or otherwise," according to Rule 702.[5] However, the legislation did not resolve the controversy because it did not contain the Frye standard or make any mention of the general acceptance standard. So, in the landmark case of Daubert v. Merrell Dow Pharmaceuticals, Inc., the United States Supreme Court established the rules. The court continued by stating that the Frye Rule was overridden by the Federal Rules of Evidence and that the strict general approval rule could not stand in the way of a fair minority

[2] *Id*.at 2.
[3] Paul W. Grimm, Chief Magistrate Judge, United States District Court, District of Maryland.
[4] Frye v. the United States 293 F.1013 (D.C. Cir. 1923).
[5] Federal Rules of Evidence. 1975.

scientific opinion in the case of recent and existing findings focused on credible studies. It also established factors for the basis of scientific evidence, known as The Daubert Guidelines. The below are the guidelines:

1) The scientific process should be used to assess the content of previously tested scientific testimony;
2) The procedure has been subjected to peer review, preferably in the form of publishing in peer review literature.
3) There are technical guidelines that are routinely and accurately followed, as well as proven or possible error rates for the technique.
4) Takes into account universal recognition in the related scientific community.

Eventually, in the Kumho Tire Case,[6] the Daubert Analysis was extended to scientific and advanced topics that do not fall into the heading of "science." The Federal Rules of Evidence were amended in the year 2000, after the creation of the Daubert Guidelines. Scientific, technological, or advanced evidence (also known as "expert testimony") is now admissible if:

(a) the expert is qualified;

(b) the expert's testimony may help the jury decide issues in the case or understand the evidence, and

(c) the expert's testimony is centered on appropriate facts or data; is the product of valid rules and techniques; and if the expert demonstrates the facts of the case in trial.[7]

As a part of this revolution, federal trial judges are now expected to act as so-called "gatekeepers" in civil and criminal courts and determine if expert testimony will be able to be considered by the jury before it lets the jury resolve questions in the case or understand the facts, according to Rule 702 of the Federal Rules of Evidence. In Daubert, Justice Blackmun, majority opinion, expressed the Court's belief in the quality of federal trial judges to serve as gatekeepers of the permissibility of scientific and technical evidence, ensuring that only eligible experts are permitted to testify on these issues, relying on sufficient facts or data, and appropriate methodology that has been properly applied to the facts of the case. He said, "When confronted with the proffer of expert scientific evidence, the trial judge must decide at the outset, according to Rule 104(a), whether the expert is proposing to testify to 1) scientific

[6] Kumho Tire Company, Ltd. v. Carmichael, 526 U.S. 137 (1999).
[7] Dr. M.P. Kantak, Dr. M.S. Ghodkirekar & Dr. S. G. Perni "Utility Of Daubert Guidelines In India" 26(3) JIAFM 110 (2004).

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information that (2) would assist the trier of truth in understanding or determining a fact in dispute." This involves deciding whether the argument or procedure behind the testimony is scientifically valid, as well as whether the rationale or techniques can be applied accurately to the facts at hand.

Associate Justice Stephen Breyer made the following statement on the role of science in court cases in the Joiner Case[8], which addressed the constitutionality of experimental evidence: "In this age of science, science should hope to find a warm reception, maybe a permanent home, in our courtrooms."[9] The reasoning is clear. The ideas and tools of science are constantly being used in court cases. The proper settlement of such cases is important not only to the litigants but also to the general population – those who live in our technologically diverse culture and whom the law is supposed to represent.

In two case laws, General Electric Co. v. Joiner and Kumho Tire Co. v. Carmichael, the Court expanded trial judges' reach under Daubert by shielding their rulings from scrutiny, enabling them to accept findings rather than the only methodology, and expanding the gate keeping position to non-scientific evidence. In joiner, the Court ruled that the appellate court could review trial judges' Daubert admissibility judgments under the violation of discretion standard and that the trial court could reject evidence based on dissatisfaction with the experts' assessments of studies instead of their procedures alone, because "conclusion and methodology are not entirely opposed."

The Court in Kumho Tire case extended the Daubert analysis beyond scientific evidence to include "technical" and "other professional expertise" as specified by Rule 702. The Court backed this finding by pointing out the legislative language's lack of differentiation, the fair award of discretion in testimony to non-scientific specialists, and the difficulties of identifying between "science" and "technical" or "other professional" expertise. The extension to Rule 702 in 2000 was the most recent advancement of federal admissibility review.

If the specialist claims to extend rules and procedures to the facts of the situation, this application must be carried out consistently. However, in some circumstances, it may be necessary for an expert to advise the fact finder on general principles without ever having to apply these theories to the particular facts of the case. For example, experts can advise the fact finder on thermodynamic principles or blood clotting principles without even knowing about or attempting to tie their evidence into the facts of the case. The amendment makes no changes to

[8] General Electric v. Joiner, 522 U.S. 136 (1997).
[9] Stephen Breyer, Introduction to Reference manual on scientific evidence (2nd edn., 2000).

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the long-standing practice of using expert testimony to educate the fact finder on broad principles. Rule 702 specifies the following for this kind of generalized testimony:

1) the expert is qualified;

2) the testimony presents a subject matter on which the fact finder may be supported by an expert;

3) the evidence must be authentic, and

4) the evidence must "fit" the facts of the case.[10]

Principles of Admitting Scientific Evidence by United Kingdom

The statute in England governing the admissibility of empirical facts differs significantly from that of the United States. According to the English precedential review, judges in the United States are hesitant to enforce certain strict criteria, such as the "reliability" test. The English courts continue to apply Lawton, L.J.'s standard common law measure of "helpfulness" in the well-known case of R vs. Turner. In England and Wales (common law) nations, the four conditions for expert opinion admissibility are (A) Assistance (B) Relevant expertise, (C) Impartiality, and (D) Evidentiary Reliability.

(A) Assistance

The leading case of Turner clarified the definition of "Assistance" by stating that an expert opinion "is admissible to provide the court with… evidence that is likely to be beyond the expertise and understanding of a judge or jury. If a judge or jury can draw their conclusions depending on the evidence, an expert's opinion is irrelevant. Or other words, if the expert's viewpoint is superfluous, it is inadmissible.[11]

(B) Relevant Expertise

The person who claims competence must be an expert in the relevant field. This point has been explained in the South Australian case Bonython.[12] According to the explanation, competence is a prerequisite that a person "has gained adequate knowledge of the subject by research or experience to make his [her] opinion of importance." It has been proposed in R (Doughty) v Ely Magistrates Court[13] that the entry for portraying skills is not very high. The criteria can be interpreted as follows: first, the entry point may not be smaller than what is needed to support a fact on the balance of probabilities; second, laypeople are not able to have those forms of

[10] Rule 702 https://www.law.cornell.edu/rules/fre/rule_702
[11] R v. Mohan [1994] 2 SCR 9, 10f (Canadian Supreme Court).
[12] The Queen v. Bonython (1984) 38 SASR 45.
[13] R (Doughty) v Ely Magistrates Court [2008] EWHC 522.

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expert proof. Third, criteria for evaluating competence must be adopted that have been established for research fields.

(C) Impartiality

The proof provided by the specialist should be objective and purposeful. Lord Woolf, the Master of the Rolls, said in Field v Leeds City Council[14] that for an expert to be "qualified to provide evidence as an expert," he or she must be able to have an independent, impartial view on the matters to which his or her evidence relates. The Court of Appeal (Civil Division) recognized expert testimony in Tooth vs. Jarman[15], holding that expert evidence can offer impartial assistance to the court in the form of objective unbiased judgment and that if an expert witness has a material or serious conflict of interest, the court is likely to fail to rule on his/her evidence.

This provision for common law admissibility has been introduced into Rule 33.2 of the Criminal Procedure Rules 2010. It states that an expert has an overarching responsibility to provide impartial and unbiased opinion evidence.

(D) Evidentiary Reliability

Besides, the expert opinion proof must meet a criterion (entry) of satisfactory reliability. Aside from these, the Court of Appeal (Criminal Division) has cited several common law admissibility provisions in various cases. They can be summarized as follows: Dallagher established that the area of specialization must be reasonably well established to pass the standard validity and reliability checks.[16] The admissibility of expert opinion testimony was quoted in Bonython, although it had not been thoroughly analyzed in England and Wales.[17] Gilfoyle proposed a different form of durability measure.[18]

This admissibility criterion was defined as follows in Bonython: "unless the subject matter of the [expert's] opinion forms part of a body of knowledge or experience that is sufficiently assembled or recognized to be acknowledged as a valid body of knowledge or experience." The common law reliability test for "expert proof of a factual nature" was affirmed by the court of appeals in Reed, although the court did not depart from the existing stance that there is no improved reliability test for such evidence. The Court of Appeal accepted the common law credibility test for empirical proof in Weller.

[14] Field v Leeds City Council [2000] 1 EGLR 54.
[15] Tooth v. Jarman [2006] EWCA Civ 1028, [2006] 4 All ER 1276.
[16] Dallagher [2002] EWCA Crim 1903, [2003] 1 Cr App R 12 at [29].
[17] [1984] 38 SASR 45 41.
[18] Gilfoyle (No 2) [2001] 2 Cr App R 5 at [25].

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The Court of Appeal stated that it is the trial judge's responsibility to decide if scientific expert testimony has a reasonably credible scientific background.

1. **The Relationship between the Four Admissibility Test**

The first aspect of the common law admissibility test known as "The Turner Test," namely "Assistance," guarantees that expert testimony can only be accepted where it has ample probative merit, which means that the evidence must assist the court in resolving a contested question. The second limb, "Relevant Expertise," and the third limb, "Impartiality," are intended to affirm that such expert testimony is admissible in criminal trials where a minimum threshold of general reliability, known as "reliability in the round," is met. The fourth leg, known as "Evidentiary Reliability," is intended to address issues beneath the expert's view, such as his/her soundness in the area of expertise and methodology of any assumptions relied on.

2. **Opinion Evidence and Evidence of Fact**

In the United Kingdom, expert evidence is classified into two types: One is known as I Opinion Evidence, and the other as ii) Factual Evidence. Since much expert testimony is focused on opinion, special guidelines are needed to ensure that it informs instead of misleads, specifically in criminal trials dominated by expert evidence. However, an expert witness can be called to provide factual testimony. When a specialist is summoned to explain how an extraordinary piece of equipment works, or to provide evidence of a reading given by an instrument or a symptom detected during a patient examination. These are referred to as proof of fact because fact often implies facts. If the court orders some credible evidence, the first three limbs of the common law test must be extended in the same manner as the branches are applied to opinion evidence. The witness providing expert proof of truth can do so only if the court needs the expert's support or support, the witness is an expert in the subject area, and the testimony presented by the witness is impartial. Although the expert Proof Of Fact is not protected by the common law rules summarized above in the case of Meads, it is claimed in "Phipson on Evidence" to choose the "Evidence Of Fact" as expert evidence where the level of competence available was of the most basic order.

Principles of Admitting Scientific Evidence by German Courts

In Germany, the court must, in general, choose an expert who has been approved by a public-law agency at the state level. The body is known as 'Kammern' keeps a registry of those experts who are selected to prevent potential difficulties in the selection of an appropriate specialist in a particular field. However, depending on the situation and situations, the court can select

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experts other than those registered with the 'Kammern,'[19] which occurs regularly in practice. The public prosecutor frequently retains experts in the preliminary criminal investigation. During the trial hearing, the complainant will insist that the expert witness be able to testify. Such a motion by the defendant cannot be denied if the expert witness called by the defendant is demonstrably more competent than the expert held by the court.[20] The complainant can also call an expert into question on a variety of legal grounds.[21] Before being approved by a 'Kammern,' the specialist must go through a screening process that assesses his personal and technical abilities to draft reports as well as his level of competence. The accreditation is applicable for a period of five years. The Kammern, for which accredited experts are registered, screens them daily. Their accreditation can be retained as long as they follow the standards. The most often used qualifications are above-average experience in a particular area, the ability to write an expert article, and the standards of impartiality and freedom. Both experiences, however, can be found in qualified experts. The German Federal Criminal Service and the numerous State Criminal Offices have extensive experience in areas such as DNA research. Expert registrations in Germany are not related to criminal proceedings.

The suitability of expertise in the subject field is one of the standards of admissibility of expert testimony in Germany. The principles of free assessment of proof regulate German evidentiary prosecutions. With a few constitutional exceptions, the court has complete jurisdiction over the admission and weighing of proof. German courts, in compliance with the standards of free assessment of proof, do not observe such evidentiary laws adhered to by US courts. In German courts, for example, hearsay testimony is admissible, and it is up to the judge to decide whether or not the evidence is compelling. The 'opinion law,' which prohibits lay witnesses from making truthful statements, and the 'best proof rule,' which requires original documents to prove the contents of the text, are not available in German courts. In Germany, judges actively participate in the collection of testimony, and the court's decision on admissibility is final. Expert opinions are usually sent to the court in writing. Where necessary, the court summons the expert for a hearing to investigate particular aspects of the expert's opinion.

(A) DNA Evidence in Germany

Blood sampling for genetic fingerprinting or DNA analysis was not legal in Germany until March 1997. The Code of Criminal Procedure (StPO) permitted the collection of blood samples from a victim for a criminal investigation. Originally, section 81a of the StPO was primarily

[19] Section 73 StPO
[20] Section 244 StPO
[21] Section 74 StPO

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used to determine the accused's blood alcohol content in cases of traffic offenses, to determine criminal guilt at the time of the crime, and, in some cases, to determine the suspect's ability to stand trial. The review of Section 81a of the StPO shows that the reason for which blood may be drawn is not defined, so collecting blood samples to collect genetic fingerprints was commonly accepted as legal within the police population. Even though the Federal Supreme Court and Federal Constitutional Court recognized section 81a as the adequate legal basis for the collection of blood samples for DNA review in criminal cases, constitutional and criminal law questions were posed by different industries. The draft amendment to the Code of Criminal Procedure, dated 2 March 1995, alleviated concern by expressly addressing the issue. The German Social Democratic Parliamentary Group (SPD) has proposed its draft code. StVAG 1997 was passed on December 6, 1996, based on previous drafts by the Federal Ministry of Justice and the SPD, but it was eventually vetoed because it did not specifically preclude the creation of gene databanks. Following that, in March 1997, the Parliamentary Act, which amended the halt, and the Administrative Offenses Act went into effect.[22]

Principles of Admitting Scientific Evidence by Indian Courts

The relevance theory governs proof admissibility in India. Section 45 of the Indian Evidence Act, 1872 deals with expert evidence. In Indian courts, the rules of admissibility state that proof can only be submitted of specific facts and facts in question. A fact can be true but not admissible, as in the case of historical testimony, where secondary evidence of a record may be provided only under such conditions. If it does not accommodate the legislative provision, a document may be relevant but not admissible. It is also possible if a text or an expert opinion is admissible whether it is original or otherwise, but because it is irrelevant, such documentation is not recognized by courts. As a result, the criterion for recognizing forensic evidence in India is relevancy and admissibility. Under the general principles of relevance,' come durability, usefulness, and fitness, which are viewed as separate grounds in the United States. Assistance, applicable knowledge, impartiality, and evidentiary credibility, which are the principles for admitting expert testimony in the UK, both fall into the category of 'relevancy.'

Sections 45 to 51 of the Indian Evidence Act, 1872 govern expert evidence law in India. In the case of **Mahmood v. State of U.P**.,[23] the Supreme Court described the term expert and stated that convicting anyone solely on the testimony of an expert would be extremely dangerous. While prosecution based on expert testimony is risky, Sections 53 and 53A of the Code of

[22] Jyotirmoy Adhikary, DNA Technology in Administration of Justice (LexisNexis Butterworths, New Delhi, 2007.
[23] AIR 1976 SC 69.

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Criminal Procedure, 1973, require that expert evidence be used in such cases. In the case of Selvi vs. the State of Karnataka[24], the Supreme Court ruled that compulsory administration of forensic techniques such as polygraphy, was unconstitutional if conducted without the accused's permission, it violates Articles 20(3) and 21 of the Indian Constitution.

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[24] 2010 (7) SCC 263.

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