CHAPTER 2

DETERMINING PROBATIVE VALUE AND ADMISSIBILITY OF SCIENTIFIC EVIDENCE

Judges and lawyers usually react to science with all the enthusiasm of a child about to get a tetanus shot. They know it's painful and believe it's necessary, but haven't the foggiest idea how or why it works.

-- Bert Black

Scientific expert testimony continues to expand to areas that are more complex and technical. It is relevant and decisively important in a rapidly growing world ushering in new inventions and innovations. Nowadays, it is unthinkable in a criminal litigation to establish a crime without a scientific proof. All branches of

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2 A variety of developments have contributed to the enormous increase in the use of scientific evidence. This development can be noted from the progression of Bertillion method (used in the 19th century to achieve identification through measurements of physical and verbal characteristics) to fingerprinting, common since the early 20th century and passed to the novel and path breaking innovation like DNA technology (recently developed methods to make use of 'Y' chromosome will provide a valuable new generation of tools for investigating sex crimes and thereby settling paternity suits with a probability of 99.9%). Other developments include, computerised matching of fingerprint records within seconds, neutron activation analysis, psycholinguists, voice prints, remote electromagnetic sensing, polygraph, electrophoresis blood testing, scanning electron microscopy, chromatography, remote electromagnetic sensing etc. For more details see, S. J. Young, "DNA Evidence", [1991] Crim. L. R. 264; P. Aldridge, "Recognising Novel Scientific Techniques", [1992] Crim. L. R. 687; Quirin Schiermeier, "Y Chromosome Analysis Used for Sex Crimes", 413 Nature 6 (2001); Comment, "The Evidentiary uses of Neutron Activation Analysis", 59 Cal. L. Rev. 997 (1971); James Morton, "Opinion", J. Cr. L. 68 (2004) (Online Publication of Lexis Nexis, Valthek Publishing, 2004); Fox et al, "The Criminalistics Mission" in C. 'Necht (ed.), Legal Medicine Annual (1972), p.1; Fong, "Criminalistics And The Prosecutor" in P. Healy and J. Manak (eds.), The Prosecutors Desk Book (1971), p.547.
science have advanced enormously during the past 50 years.\textsuperscript{3} Forensic science has emerged as a good hand, aiding and guiding the adjudicating body. Moreover, the developments in science result in the formulation of several new disciplines. This paves the way for the introduction of new techniques and proliferation of experts.

Thus by the development of scientific and technical expert testimony in the complex and technical issues has flooded the judicial system, the question of its reliability and admissibility has also plagued the courts and engendered much debate. The issue of admissibility has attracted the attention of countless commentators. Several articles have explored the subject and offered arguments supporting greater or lesser barriers to the admissibility of scientific expert evidence.\textsuperscript{4}

2. General Principles of Relevance and Admissibility

One of the distinguishing features of the legal system is that it has evolved a set of process for its own use to screen and handle the complexities arising from the invasion of alien subjects. It does not discard the external environment

\textsuperscript{3} Paul C. Giannelli identified the factors that have contributed to the increased use of scientific evidence. They are (1) research funding, (2) courts influence; (3) the reliability of scientific proof etc. In United States, Supreme Court has given much recognition and placed great reliance on the use of scientific evidence in Crime detection. For example, in \textit{Breithaupt v. Abram}; 352 U.S. 432, at 439 (1957), U.S. Supreme Court wrote, "Modern Community living requires modern scientific methods of crime detection lest the public go unprotected". A 1974 survey conducted in judges and lawyers throughout the United States shows that 70 percent believed that juries and judges find scientific evidence more credible. See, M. Saks and R. Van Duizend, \textit{The Use of Scientific Evidence in Litigation} (1983), pp.5-6 as quoted in Paul C. Giannelli, "The Twenty-first Annual Kenneth J. Hodson Lecture- Scientific Evidence in Criminal Prosecutions", \textit{Milt. L.Rev.} 167 (1992).

but seeks to react and interact with it through a process, which remains essentially a tool of the legal system. Judiciary will not admit all evidence that comes before it, at its face value. When a fact is adduced as evidence before a court of law, it must have some bearing on the proposition at issue, which means it must be relevant to the fact in issue. All other evidence will be excluded as irrelevant. This general rule has been accepted in all jurisdictions.⁵

(A) What is ‘Relevance’?

‘Relevance’ is the first requirement that any piece of evidence tendered in court must satisfy. The word ‘relevance’ has no special legal significance. It is used in the legal terminology as an everyday word used by common man. However, in law, it is considered continuously in decision-making process. Here it is pertinent to analyse the word relevance in legal framework, because it is very much connected with this topic. Many jurists have made comments on the word ‘relevance’. In utilitarian language, Bentham employs the concept of relevance while defining the word evidence.⁶ He says:

One fact is relevant to another if the effect or tendency of the former when presented to the mind is to produce a persuasion concerning the existence of some other matter of fact.⁷

Thus the relation between ‘factum probandum and factum probans’ is called relevance. Unfortunately this definition was criticised by many writers. The major criticism was levelled against his subjective attitude, dealing with

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⁵ For example, in India, The Indian Evidence Act, Section 6 states that, “evidence may be given in any suit or proceeding of the existence or non existence of every fact in issue and of such other facts as are here in after declared to be relevant, and of no others”. Relevant facts are specifically provided under Section 6 to 55. See, Indian Evidence Act, 1872.

⁶ Bentham, Rationale of Evidence (1827).

⁷ Ibid.
psychological effect. They state that, as a rational animal, one must endeavour to relate one's belief to a natural reality.\(^8\) Other arguments levelled against his definition was that, a factum probandum couldn't be established with absolute certainty. This is based on the principle that "relevance is an affair of probability and not of certainty". What is often regarded, as proof is only a high degree of probability.\(^9\) However, critics justify one aspect of Bentham's definition. They support Bentham in stressing the relativity of evidence. According to them, "Evidence, factum probans, is always relevant to some factum probandum; there is no relevance in the air."\(^10\)

An English jurist, Sir James Fitzjames Stephen, gave more or less a suitable definition for relevance.\(^11\) He introduces the language and concept of relevancy by considering the various meanings of the word evidence.\(^12\) He explained the word relevant as follows:

...any two facts to which it is applied are so related to each other that, according to the common course of events, one, either taken by itself or in conjunction with other facts, proves or renders probable the past, present, or future existence, or non-existence of the other.\(^13\)

For Stephen, relevancy is the principle of natural evidence. He says that a proffered testimony may not be given of facts, which are not relevant to facts in

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\(^8\) According to them, the subjective attitude of juries incorrectly reflects the actual relationships between facts, and judges may withdraw from the jury's evidence, which is not relevant. Bentham's major critique was Best, *Principles of The Law of Evidence* (1849 ed.), Art. 34.


\(^11\) His definition is still in force in the English Legal System.

\(^12\) Stephen listed four different meanings of the word evidence in the Indian Evidence Act.

issue. He has stated that, judicial evidence is generally determined by the common course of events, science and inductive logic,\textsuperscript{14} because when an inquiry is pushed further and the nature of relevancy has to be considered in it, apart from legal rules, we are led to inductive logic. According to him, certain classes of facts, however, usually be regarded as falling within the definition of relevancy are excluded from it by the law of evidence. They are named as similar facts, hearsay, opinion and character. In his view, where relevant evidence is excluded by a rule of law, such evidence must be deemed to be irrelevant.\textsuperscript{15}

It is submitted that Stephen has misconceived the terms ‘relevance’ and admissibility. He used the term relevance for admissibility. The admissibility of evidence is settled by the policy of law and not by relevance. Hence, if a particular piece of evidence though relevant will be excluded by a court of law on policy considerations, it cannot be considered as irrelevant. Stephen has obscured the nature of relevance and its relation to receivability.

It was Thayer, who rightly distinguished rejection of evidence by a court of law because of want of relevance and the rejection of evidence, even though

\textsuperscript{14} Thus Stephen has given a different meaning to the term relevance. He used natural reality different from psychological element to identify a fact as relevant to a fact in issue or relevant fact. He rightly stated that evidence couldn’t be determined nearly by legal parameters. Therefore, he suggested science and inductive logic to be regularly used for determining the relevancy of a particular fact.

\textsuperscript{15} In Article 2, Stephen stated that, “Evidence may be given in any proceeding of any fact relevant to any fact in issue, unless it is hereinafter declared to be deemed to be irrelevant, and of any fact herein after declared to be deemed to be relevant to the issue, whether it is, or is not, relevant thereto. Provided that the judge may exclude evidence of facts which, though relevant or deemed to be relevant to the issue, appear to him too remote to be material under all the circumstances of the case”. Stephen, Digest of the Law of Evidence (12th ed.). Phipson criticised Stephens usage “deemed” as confusing. He says that many of the exclusionary rules that Stephen used as instances or “deemed irrelevance” are not associated with relevance. He cited an English decision, R. v. Blastland, (1986) A.C. 41, where Lord Bridge said, ‘Hearsay Evidence is not excluded because it has no logically probative value’.
relevant, because of some policy of the law. For distinction he used the words "relevance" and "admissibility". According to him, the term relevance is an extra legal concept. He used "logically probative" as a synonym for "relevant". He says, though the concept of relevance was a presupposition of a rational system of evidence, it was not the function of the law of evidence to determine whether particular kind of evidence was relevant or irrelevant. He has stated two principles connected with relevance. The first is the principle, which forbids receiving anything irrelevant, not logically probative. The second one is, unless excluded by some principle or rule of law all that is logically probative is admissible. He states these two basic principles are principles of English law. The first is a negative and the second a positive principle. A particular instance of the negative principle was stated by Viscount Simon in R. v. Harris, "Evidence of 'similar facts' cannot in any case be admissible to support an accusation against the accused unless they are connected in some relevant way with the accused and with his participation in the crime". The court in R v. Sims accepted the second principle in these terms: "All evidence that is logically probative is admissible unless excluded". In England, these principles were criticised by Stephen that it is not self-evident. But in United States it has been approved. Phipson and Nokes later adopted this.

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16 Thayer, Preliminary Treatise on The Law of Evidence, Chapter VI. Thayer was against Stephens question "what facts are relevant"? Thayer says that, such question was for science and not for law of evidence.

17 [1952] 1 All ER 1048.

18 (1946) K.B. at 539.

19 Phipson, Law of Evidence (9th ed).

20 Nokes, Passim, at p.69. Chapter V.
Wigmore\textsuperscript{21} was the first person who rightly considers that it is necessary to distinguish between (a) the rejection of evidence because it is not relevant to facts "sought to be established" thereby; and (b) the rejection of evidence because it is not relevant to a "fact in issue". He advised that it is better to use the word "materiality" instead of relevance to the latter and reserving "relevancy" strictly for the former.

The "materiality" of evidence means the evidence, which is concerned with an issue before the court. The term does not mean whether the evidence is adequately related to the facts sought to be established, but whether those facts are adequately related to the case made by the party. According to Wigmore, "materiality" defines the status of the proposition sought to be proved to the case at large.

In current terminology, Powell\textsuperscript{22} states that relevancy is concerned with "what facts a party will be allowed to prove at the trial of any legal proceeding." Cockle\textsuperscript{23} uses the term in a manner, which fails to make any distinction between materiality, relevancy and admissibility.\textsuperscript{24}

The next important question is whether the law of precedent on question of relevance is binding on subsequent cases? For this question, Wigmore answered in an affirmative sense. He argues:

\textsuperscript{21} Wigmore, \textit{The Law of Evidence} (3\textsuperscript{rd} ed).
\textsuperscript{22} Powell, \textit{Law of Evidence} (3\textsuperscript{rd} ed).
\textsuperscript{23} Cockle, \textit{Cases and Statutes on Evidence} (5\textsuperscript{th} ed), p. 58.
\textsuperscript{24} U.S. \textit{Federal Rules of Evidence}, Rule 401 was drafted in this manner. Rule says relevant evidence as "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence".
So long as courts continue to declare in judicial rulings what their notions of logic are, just so long must there be rules of law, which must be observed. For these rules the only appropriate is the law of evidence.\textsuperscript{25}

According to Thayer, the doctrine of precedent is inapplicable because relevance is not an affair of law. He says, the law has no orders for the reasoning faculty, any more than for the perceiving faculty for the eyes and ears.\textsuperscript{26}

From the above discussion, it is submitted that the Thayer's view was right, because one cannot say that the doctrine of precedent always includes the field of relevance. Precedent may generally apply to a question of relevance. For example, whether particular novel scientific evidence is relevant or not is a question of relevance and an apex court can settle it. But this does not mean, that particular novel scientific evidence is relevant for all cases that subsequently come. This is because the question of relevance is based on the reasoning faculty of a judge. He must use it according to the circumstances of each case.

From the above discussion one can conclude that the various definitions given by distinguished jurists will help only to get a theoretical basis about the concept of relevance and it cannot provide a better help to determine relevancy. Therefore, the judge must rely on logic and experience to evaluate the probabilities on which relevancy turns. In order to substantiate the statement it is worthwhile to quote Thayer's language:

\textit{...Our law of evidence is a rational system, as contrasted with certain older modes of proof; that in admitting evidence in our law, it is always assumed

\textsuperscript{25} J. Wigmore, \textit{Evidence} (1943), p.23.

\textsuperscript{26} J. Thayer, \textit{A Preliminary Treatise on Evidence At Common Law} (1989 ed.), p.265.
to be logically probative, i.e., probative in its own nature, according to the rules that govern the process of reasoning; that the considerations determining this logical quality are not fixed by law, and that, so far as legal determinations do proceed merely on such considerations, they do not belong to the domain of law; that the law of evidence, however, excludes much which is logically good, that is to say, good according to the test of reason and general experience.27

(B) Legal Relevancy and Logical Relevancy

Legal relevancy is the part and parcel of logical relevancy. However, legal relevancy is different from logical relevancy because the former demands a close connection between the fact sought to be proved and the fact offered as evidence in proof of fact sought to be proved. Legal relevancy requires a high standard of evidentiary force. Moreover, under legal relevancy, court may reject many things as irrelevant, even though it is probable and highly connected with a fact in issue, on the grounds of convenience or policy. But this practice was criticised by Phipson as incorrect, because in his view the question of relevance and admissibility are different.28

It is submitted that the propositions cannot be said to be fully correct, because the test of relevancy is a preliminary test for determining admissibility.

27 J. Thayer, "Law and Logic", 14 Harv. L. Rev. 139 (1900). This article was the reply given by Thayer for another article, "Law and Logic", written by Jubez Fox in the same volume at p 39. In that article Fox criticized Thayer for his demarcation between law and logic. For that, Fox quoted a statement of Justice Holmes, to support his argument. Holmes has stated that "the notion that the only force at work in the development of the law is logic" condemns as fallacious. See Holmes, "The Path of the law", 10 Harv. L. Rev. 465. Thayer's distinction between law and logic is indicated in the following sentence: "Admissibility is determined, first, by relevancy, - an affair of logic and experience, and not at all law; second but only indirectly, by the law of evidence, which declares whether any given matter which is logically probative is excluded". Thayer, Preliminary Treatise on Evidence, at p.269.

Therefore, the question of relevancy is also a matter of admissibility, even though the admissibility had some predominance over relevancy. Therefore it is better for a judge while determining relevancy to foresee the questions that may arise while determining admissibility. Otherwise, it may result in the wastage of the court's time. Therefore, here it is submitted that the question of relevancy is always dependable on the question of admissibility.

The facts that may not be admitted cannot be rejected in full force as irrelevant. High legal straightjacket factors like convenience and policy are the matters that shall be considered in deciding admissibility and not relevance. Its rigour shall not affect relevance. Therefore, almost in all jurisdictions, the question of relevance and admissibility were separately discussed. For example, in United States Federal Rules of Evidence, relevance is defined in Rule 401 and its exclusion is provided in Rule 403. Rule 403 provides that:

Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time or needless presentation of cumulative evidence.29

Thus relevant evidence can be excluded only if its probative value is "outweighed" by the factors as provided. Here the question is, if the probative value of relevant evidence is in equal balance with the danger of unfair prejudice or if the probative value is very higher, whether it shall be excluded. In State v. Chapple,30 Arizona Supreme Court got an opportunity to consider this issue. In this case the accused was charged and convicted for murder. Before the

appellate court, he contended that the trial court erred by admitting certain pictures of the dead body, because the pictures were gruesome and inflammatory. Regarding this court said:

Photographs having probative value are admissible in evidence.... They must, of course be relevant to an issue in the case and may be admitted in evidence to identify the deceased... although they may also have a tendency to prejudice the jury against the person who committed the offence. The discretion of the trial court will not be disturbed on appeal unless it has been clearly abused.\(^{31}\)

The correct procedure to be followed in such circumstances has been clearly explained by the United States Supreme Court in *Old Chief v. United States* (11).\(^{32}\) Souter J., delivered the opinion of the court:

...the court would decide whether a particular item of evidence raised a danger of unfair prejudice. If it did, the judge would go on to evaluate the degree of probative value and unfair prejudice not only for the item in question. But for any actually available substitutes as well. If an alternative were found to have substantially the same or greater probative value but a lower danger of unfair prejudice, sound judicial discretion would discount the value of the item first offered and exclude it if its discounted probative value were substantially outweighed by unfairly prejudicial risk... the judge would have to make these calculations with the appreciation of the offering


\(^{32}\) 519 U.S. 172 (1997).
parties need for evidentiary richness and narrative integrity in presenting a case.\textsuperscript{33}

This decision can be said to be a rightful approach in dealing with such circumstances. However, court was silent about the decision to be taken in cases in which there is no reasonable substitute having the greater probative value and lower danger of unfair prejudice. From the reasoning of the court, one may reach the conclusion that in such circumstances the evidence shall be excluded.

Thus legal reliability asks whether the evidence is worthy of serious consideration in the particular context in which it is offered. But scientific reliability is built upon probabilistic calculation. If more probable the scientific proof, then more reliable will be the evidence. Probability of a scientific proof depends on various factors. In a landmark decision \textit{Daubert v. Merrell Dow Pharmaceuticals Inc.}\textsuperscript{34} United States Supreme Court has established the test for scientific reliability. In this case court stated that, a case involving scientific evidence, evidentiary reliability would be based upon scientific validity.

\textbf{(C) What is Admissibility?}

After relevance, the next step is to determine the admissibility of evidence. Admissibility is something different from relevance. Evidence, if relevant need not be admissible. Concept of admissibility is negative. Different from relevancy, the question of admissibility exclusively depends on the rules provided by law. A piece of evidence is inadmissible if it is rejected for some reason other than immateriality or irrelevance, and it is admissible if there is no rule for its rejection other than materiality or relevance. The best example is Rule 403 of the Federal

\textsuperscript{33} \textit{Ibid.} at 182-83.

\textsuperscript{34} (1993) 125 L.Ed. 2d 469 (Court formulated certain factors to be considered for determining the admissibility of scientific evidence).
Rules of Evidence in United States. It provides that: “Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence”. From the above discussion it follows that, the concept of relevance is one of reason and logic and the concept of admissibility is one of law.

3. Issues in the Admissibility of Scientific Evidence

Law has always sought the assistance of science, and this has been increasing day by day. More discussions have taken place about law and its relationship with other disciplines like history and sociology. But the discussion between law and science had begun only recently. One of the main reasons for this late meeting is the difference in the methodology between law and science. Law is found only in standard legal scholarships, which can be taken.


36 Science involves a body of generalised, systematised and transmissible knowledge. It offers a highly-refined premises based on sophisticated techniques for observing and measuring the phenomena of the real world, often expressed in the form of casual relationships or regularities of recurrence and sometimes reduced to quantitative or statistical forms. See, Harold L. Korn, “Law, Fact and Science in the Courts”. 66 Colum. L. Rev. 1080 (1966). Difference between legal and scientific methods were identified in an article published in Michigan Law Review. It is as follows: “The first step in the scientific method is the formulation of hypothesis or tentative theory. The second step is to make predictions suggested by the theory. If they do, the theory is tentatively confirmed; if they do not, the theory is disproved. But in the case of law, first-the nature of the particular truth in question is different-the court looks for particular facts to which the law s to be applied, while the scientific method seeks to establish “laws” or general truths! Secondly- the legal method assigns specific roles to different persons in the trial process. In particular this process places great emphasis upon the role of adversaries in the truth finding function. Thirdly, the legal method sometimes consciously sacrifices its truth-seeking goal to other values such as efficiency and competing social values. Fourthly- the legal method has a means of resolving factual disputes in the presence of uncertainty or ignorance: the party having the burden of proof looses when it fails to persuade the trier of fact. In contrast, the scientific method simply defers decision for which information is inadequate”. See, James A. Martin, “The proposed Science Court”, 73 Mich. L. Rev.
from the legal works like law review articles and comments. Legal scholarship also differs from scientific principles in the resources it uses. Natural scientist uses data, which are defined and given significance by the academic discipline that studies them. Scientists, even though they are in different branches of science will share a common methodology. But in the case of law they are not using a common principle. It may differ from nation to nation. The legislators and judges in accordance with the circumstances of the case in hand and social needs create them. Therefore, Ronald Dworkin has said: "True legal scholarship today has its links with formalist traditions: it recognizes the human element in legal decision-making".

The other main distinction between science and law is that, in science commonsense has no place. Authorities opined, ideas, which fit with common sense, might almost certain to be false scientifically. Whatever it may be, within a short period, science became an active truth finder in legal field. Reliability is the reason that makes the scientific proof more attractive. However, reliability

1058 (April-May 1977). Science and the law differ fundamentally in their objectives. The objective of the law is justice; that of science is truth. These are not at all the same thing. Justice, of course, also seeks truth, but it requires that a clear decision be made in a reasonable and limited amount of time. Both disciplines seek, in structured debate, using empirical evidence, to arrive at rational conclusions that transcend the prejudices and self-interest of individuals. See, David Goodstein, "How Science Works" in Federal Judicial Center (ed.), Reference Manual on Scientific Evidence (2nd ed. 2000), pp. 80-82 as quoted in Michael C. Mason, "The Scientific Evidence Problem: A Philosophical Approach", 33 Ariz. St. L. J. 857(2001).

Scientific principles and concepts are constant. Changes in the society do not affect science. Like law science will not adjust its own environment for other social disciplines. But changes in the scientific environment may reflect in other disciplines. This is because science is not a social process, But we can rely science due to its sophisticated principles in determining or searching truth.


of science is different from reliability of law. In science, almost in all cases of change, old principles are not so much discarded by the new ones. New ideas are incorporated into a common body of knowledge keeping the old ideas constant. Therefore, law can believe science as a true problem solver.\textsuperscript{41}

(A) The Concept of "Junk Science" in Legal Scholarship

Since 1970's forensic scientific evidence has been seriously criticized.\textsuperscript{42} Almost all criticisms were focussed on its reliability. Eminent scholars of scientific evidence believe that the concept of "junk Science" is the cause for this problem. The cause is centred on the fact that courts are not appropriate in screening novel scientific evidence. Therefore, here it is pertinent to discuss the concept of junk science and its impact on criminal adjudication process.

"Junk-Science", the sibling of scientific advancement has been begotten recently.\textsuperscript{43} Actually, the concept has been used to identify the problems in the law-science relationship. The junk science has emerged as a powerful "polemical tool". This was due to a litigation explosion of 1980's in the United States tort law.

\textsuperscript{41} Many inventions and discoveries in science benefited the legal scholarship. Similarly the scientific need in law also profited the scientific research.


The phrase "Junk Science" was coined by Peter Huber to describe judicial acceptance of unreliable scientific evidence.\(^44\) His book, 'Galileo's Revenge junk science in the Court Room',\(^45\) sparked a heated debate about the nature and extent of the abuse of science in litigation. But no one has given a clear or suitable meaning for the term junk science. In the discussions on law and science one can find certain synonyms for junk science like "pejorative", "inflammatory" and "imprecise". These labels are used interchangeably.\(^46\) However, the distinctions in science like "good science", "bad science" and "pseudo" begun long before 1923. Some scholars used these terms to describe knowledge claims which are not generally accepted or in the main stream of knowledge.\(^47\) Some others distinguish junk science with novelty. The other set differentiates novel science that uses legitimate methods from that which reaches illegitimate and dubious conclusions. Some others focus upon the purported unreliability or non-experimental nature of junk science.

In the introduction to his book, Peter W. Huber states that Junk science is the mirror image of real science.\(^48\) Junk science cuts across chemistry and pharmacology, medicine and engineering. It is a catalogue of every conceivable kind of error: data dredging, wishful thinking, truculent dogmatism, and outright fraud. In legal sense, he said, junk science is matched by liability science, a

\(^44\) Peter W. Huber, Galileo's Revenge: Junk Science In The Court Room (New York, 1991).
\(^45\) Ibid.
\(^48\) Peter W. Huber, Supra n.44, at p.2.
speculative theory that experts, lawyers, judges and juries search for causes at the far fringes of science and beyond.49

The main task of a fact finder in law science relationship is to detach good science from bad science. This separation is important because, otherwise junk science may intrude into the set of evidence and collapse the entire process. But this will be a very difficult job for judges, who have only a limited knowledge about science. Therefore, they have to depend on persons who had a systematic and deep knowledge in scientific discipline. Here it is pertinent to make an analysis of the distinctions made by various authorities on the subject, and examine how far they have succeeded in differentiating good science from junk science.

Scientific community has accepted that all forms of junk science were in conflict with real science.50 In science, good science has been generally considered as having qualities like falsifiable hypothesis, replication, verification, peer review, publication, general acceptance, consensus, universalism, organised skepticism, neutrality, experiment, objectivity, dispassionate observation, naturalistic explanation and the use of scientific method.51 But it has been established that it is nonsense to distinguish good science and junk science with these qualities, because most of these qualities are also displayed by junk science.52

49 Ibid. at p.3. As an actual promoter of junk science Huber said, “We have no precise definition of "Junk Science", "Pseudo Science," "Quack", "Crank" and "Crack Pot Science".


52 Considering these difficulties, Martin Gardner has rightly stated as follows:
Robert Weyant has given a somewhat clear idea in separating science, proto-science and non-science. According to him one of the ordinary demarcation between real and junk science is that the former results in technically, efficacious outcomes, whereas the latter does not have. He opined, junk science may exhibit all the signs of a real science but practically it may be inferior to the real science, sometimes this science will exhibit all the qualities of real science. But in practice it may be like the mirror image of real science, but none of the same substance. He said a real science is testable in principle through sensory experience. Thus through a simple technique Weyant has given, one can identify good science from bad science. However, no criterion has provided by Weyant to differentiate it from heavy courtroom science. Therefore, the demarcation made by Weyant is vague and it cannot be used in particular situations.

Some scientists to distinguish junk science from good science have used motivation, as a factor. Scientists like James D. Watson will come under this group. According to him, financial motivation will be there and it is essential to career development and for academic and institutional survival.

No one can define exactly what is meant by such words as pseudo science, crank and crackpot. The reason is simple. There is no exact way to define anything outside pure mathematics and logic, and even there some basic terms have extremely shaggy edges. See, Martin Gardner, Science: Good, Bad And Bogus (Prometheus Books, 1989), at Xiii as quoted in Peter Huber, Medical Experts and the Ghost of Galileo”, 54 L. & Contemp. Probs. 121 (1991).


James D. Watson, The Double Helices: A Personal Account Of The Discovery Of The Structure Of DNA (1968). According to him this motivation is not separable especially in some of the new areas like biotechnology and microelectronics. But this was later criticised by Harry Edmond and David Mercer that, financial factors will provide powerful motors for many fields of contemporary science. See also, Harry Edmond and David Mercer, “Trashing "Junk Science". Stanford Tech. L. Rev. 3 (1998).
Huber says that good science could be distinguished from junk science by asking certain questions. First, does a putative scientist base her conclusions on demonstrable facts or does she just repeat her theory by way of endless illustration? Put differently, does the scientist place fact upon fact, like brick upon brick, to erect a solid wall of argument, or does she merely raise castles of conjecture in the air? Second, how accurate and reliable or how distorted are the facts that she uses? Thirdly, how willing is the scientist to present all sides of a controversy and to acknowledge inconvenient facts that tend to disprove his hypothesis, i.e., to tell the complete story—"the truth the whole truth, and nothing but the truth"—rather than including just those facts that confirm his theories. According to him the junk scientist shall fail these three tests.

(B) Impact of Junk Science

Much effort was given to explain the problem of junk science in civil litigations like corporate toxic tort cases, ignoring similar problems in criminal prosecutions. Peter Huber has also concentrated his work in civil litigations. One has to give more attention to the problem of junk science in criminal cases rather than civil disputes because in the former there are chances of taking a person's life itself by the participation of a junk science. Moreover, recent forensic statistics shows that scientific evidence has been used very widely in

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55 Peter Huber, *Supra* n.44; David L. Faigman gave another suggestion to distinguish good science from bad science. He said that most of the scientists have a simple, universal scientific method, which could distinguish good science from junk science. He wrote, "Although the scientific method continues to attract its share of detractors and sceptics, the significant advances in science and technology in the twentieth century illustrate the power of that method. The substantial level of sophistication in the scientific method will be necessary if judges are ever going to integrate science successfully in to their legal decisions". See, David L. Faigman, *Mapping the Labyrinth*, *Supra* n.4.

56 This may be due to the explosion of tort cases. The other areas are medical liability litigations, product liability cases and environmental liability litigations.
criminal prosecutions. This will include the latest DNA profiling and sophisticated techniques like neutron activation analysis, atomic absorption, mass spectrometry, scanning electron microscopy, voice prints, trace metal detection, horizontal gaze nystagmus, social science evidence etc.

The only criminal case discussed by Peter Huber as an example for explaining the impact of junk science was *Barefoot v. Estelle.* This case gains importance not only as an evidential issue but also as an issue violating the constitutionality. The brief facts of the case were that the trial judge of Texas for the offence of murder convicted one Thomas Barefoot. During the penalty phase of the trial, the prosecution offered the testimony of a psychiatrist, for testifying about Barefoot’s “future dangerousness”. Determining “future dangerousness” is one of the qualifying factors under the Texas Death Penalty Statute. Article 37.071 and 2 (b) (1) of the Texas Criminal Procedure Code requires that, a “jury must find out the probability that the defendant would commit criminal acts of violence that would constitute a continuing threat to society”. But, the criteria to be considered by a judge while looking the probability has not anywhere provided in the Act. The constitutionality of this Statute was also upheld by the Supreme Court in *Jurek v. Texas.* Unfortunately, in this case one Dr. James Grigson was appointed by the prosecution to testify Barefoot’s future dangerousness. Without examining Barefoot, he gave evidence that there was a “one hundred percent and absolute chance” that Barefoot would commit future acts of criminal violence. This was challenged by Barefoot before the Supreme Court, saying

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60 *Supra* n.58 at 919.
that, due to the unreliability of evidence it shall violate the Due Process Clause and the Eighth Amendment's cruel and unusual punishment Clause.

An amicus brief was given by the American Psychiatrist Association, in which it was stated that, "unreliability of psychiatric predictions of long term future dangerousness is by now an established fact within the profession". They also estimated that two out of three predictions of long-term future violence made by psychiatrists were wrong. A substantial body of research also supported American Psychiatric Associations statement. Moreover, while cross-examining Dr. Grigson, he stated that only a minority of psychiatrists had accepted the studies of "determining future dangerousness and these studies did not represent the view of the American Psychiatric Association." 62

Nevertheless, court ruled that the testimony of Dr. Grigson was not constitutionally infirm. Regarding this, White J., has said, "neither petitioner nor the American Psychiatric Association suggests that psychiatrists are always wrong with respect to future dangerousness, only most of the time". 63 The court held that, such testimony is not almost unreliable. 64

This case shook the conscience of the judiciary. The court admitted the Social Science testimony in a very liberal manner, without any screening. In this case court ought to have considered the statement made by the American Psychiatric Association regarding the reliability of psychiatrists guidance about future dangerousness. The other significant thing in this case was that Dr. Grigson has testified the future dangerousness without examining Barefoot

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61 Ibid. at 920.
62 Ibid. at 919.
63 Ibid. at 901.
64 Ibid. at 899.
personally. These things show that junk science has intruded into this case leading to the award of death penalty to Barefoot. Huber rightly notes these as "one could favour the death penalty and yet still recoil at the thought that a junk science fringe of psychiatry... could decide who will be sent to the gallows".65

In England66 and Australia67 also the problem of junk science has become a subject of debate among legal scholars due to the conviction on the basis of unreliable scientific evidence.

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65 Peter Huber, Supra n.44, at p.220. In the said case the descending statement made by Justice Blackmun is praiseworthy. He said: "In the present state of psychiatric knowledge this is too much for me. One may accept this in a routine lawsuit for money damages, but when a person's life is at stake a requirement of greater reliability should prevail. In a capital case, the specious testimony of a psychiatrist, coloured in the eyes of an impressionable jury by the inevitable untouchability of a medical specialist's words, equates with death itself. (at p.916).

66 In England, the case that gathered widespread agitation was, Preece v. H.M. Advocate, [1981] Crim.L.R. 783. In this case scientific evidence was reassessed in the light of new evidence. The accused in this case was a lorry driver who was convicted by the trial court for the murder of a woman. Before the trial court the principal evidence against him was the scientific evidence of blood, seminal stains, hairs, fibres and some grass seeds. At the time of trial, the prosecution gave testimony of a scientist who had examined the seminal stains on the victim's pants and identified them as belonging to blood group-A. He also stated that the accused was of blood group-A. But the expert failed to mention that the victim also had the same group and that the stains probably included some of her secretions. Later the expert testified that he could tell the difference between male and female secretions. But this method of identifications had never reported in the scientific literature. Jury convicted the accused and he was in jail for seven years. On appeal, court overturned the conviction after finding that the evidence presented by the expert was doubtful. One of the important flaws made by the trial judge in this case was that he admitted the scientific expert's evidence without looking into the accuracy of the evidence. In this case the expert did not cover the essential facts in his evidence or supplied the essential materials for challenging its validity. Hence junk science had intruded into the case with the knowledge of the trial judge.

67 In Australia, the controversial decision in this area is R. v. Chamberline (known as the Dingo Baby case), 153 C.L.R. 421 (1984). In this case the accused Chamberlain was charged for the murder of her baby. The prosecution case was that she cut her baby's throat in the family car and buried it in the sand. According to the prosecution, the accused disinterred the body of the baby and cut the clothes of the baby to simulate damage by a dingo (wild dog). At the time of trial both parties introduced complex and contradictory scientific evidence on the issues about the origins of the cuts on the baby's garments, the ability of a dingo to carry a baby and regarding the blood stains found in the accused's car. At the end of trial the judge warned the jury that if they did not understand the scientific evidence they could decide the case based on their common sense. The jury convicted the accused. On appeal, the defendant challenged the jury instructions and the validity of the scientific evidence
4. **Solving Junk Science Problem-Methods**

No issue has generated so much heat as much among legal scholars as the controversy over the junk science problem. It was only after the publication of Peter Huber's *Galileo's Revenge* in 1991, the problem got heated. Since 1991 many legal and scientific scholars gave attention to treat this disease. Before going to solve this issue, it is relevant to identify certain unanswered questions in the field. They are (1) whether juries are able and willing to distinguish junk science from good scientific evidence? (2) If juries are not willing and capable to judge the problem, then what is the method by which bad science can be excluded? As far as judges were concerned, judging science is not an easy process. Realizing this difficulty, in some countries they have taken steps to reform the forensic science system itself or tighten the rules regarding admissibility. But cases show that this will yield only little. Therefore one has to outline certain methods to be followed by a judge while dealing with scientific evidence. They are as follows.

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68 In England, the United Kingdom Royal Commission on Criminal Justice has taken steps to improve the quality of forensic science and scientists. They have established a new authority known as the Forensic Science Advisory Council. The Council should investigate and give report to the Home secretary, regarding the performance and efficiency of forensic science laboratories. Similar steps have also taken in Australia. In Australia, after the controversy in *Chamberlain* decision, Australian Law Reform Commission recommended a new Evidence Code. The Law Reform Commission in Australia considered that discretion could be used to exclude evidence that has not sufficiently emerged from the experimental to the demonstrable stage. When one analyses the Statute and legal literature in Australia and New Zealand, can find out that in these countries they are imitating the procedures of the United States. Rule 403, 702 and 703 of the United States Federal Rules of Evidence are the touchstone of the Australian Evidence law regarding the admissibility of expert evidence. Leading decisions in the United States have also made a major breakthrough in the Australian Expert Evidence Law. For more details see, David E. Bernstein, "Junk Science in the United States and The Common Wealth", *Yale J. Int'l L.* 123 (1996).
(A) Evaluating the Theory and Technique Involved in the Testimony

Normally, in a scientific testimony the scientist will place the scientific theory and technique before the court of law. His entire scientific evidence will be based on that theory and technique. In such occasion court cannot act as a spectator because judges are the appropriate persons to decide which theory or technique has to enter into the legal field. For that a judge must measure a scientific theory and technique in question, not only from the view point of its proponent but from the view point of a non-collaborator, outside the laboratory from which the particular theory or technique has developed. That means, the court should confirm that the particular theory and technique have got a general acceptance in the relevant scientific community. In United States, this trend has started since 1923, after the reporting of the path-breaking decision Frye v. United States. Relevant portion of the judgement is as follows:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognised scientific principle or discovery the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.

This case later came to be known as the Frye test and became the majority rule in the United States jurisdiction. However, the Frye decision has provided only a general rule in admitting novel scientific evidence. The courts in

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69 293 F.1013 (D.C. Cir. 1923).
70 Ibid. at 1014.
United States then modified this test, without changing its cardinal principle. Thus in *People v. Young*, court defined the "relevant scientific community" which was propounded in *Frye* decision. The court said, the person who is a member of the relevant scientific community must be a disinterested person regarding the particular issue and he must not be a person who is depending for his livelihood on the use of that new technique.

Thus in this case, instead of admitting the testimony of the director of the Federal Bureau of Investigation, Serology Laboratory (who was the developer of the technique), court admitted the opinion given by a professor of public health at the University of California. The court has also stated that the relevant scientific community shall include a retired academic biochemist who was a recognized leader in developing electrophoresis to test body-fluid enzymes for forensic purposes.

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71 391 N.W. 2d 270 (Mich. 1986). The facts of the case show that the accused Jeffery Allen Young was convicted of first-degree murder. One of the material evidences against the accused was the dried bloodstain, which was tested by a new technique known as the electrophoresis. Before the Supreme Court, the precise issue in this case was whether electrophoresis of evidentiary bloodstains passes the general acceptance tests.

72 *Ibid.* at 276. Regarding this Levin J., observed: "If the court were to adopt the view that testimony of persons who have developed and whose reputation and livelihood depends on the use of a new technique alone supports admissibility, then the views of the developer and his disciples would be substituted for the scrutiny of the market place of general scientific opinion and the substance of the Frye test would be eliminated".

The reason for this warning is to avoid certain bias or special interest of the acceptor. For that he must not be a collaborator or an employee in the laboratory of the founder of the theory or technique.

73 *Ibid.* at 275-76.

74 *Ibid.* Similarly in *U. S. v. Yee*, 134 F.R.D. 161 (N.D. Ohio 1991) prosecution experts DNA test results (including theory and technique) came for admissibility. Court stressed that the presence of expert testimony, both with the community of scientists who helped to develop the technique and outside of the community is critical to a finding of general acceptance. In this case there was evidence outside the FBI's forensic lab that the FBI's DNA procedures were generally accepted. Therefore,
However, for courts, a mere disinterested person will not serve the purpose, but they are insisting a disinterested person who has been accepted by the relevant scientific community. Membership in a requisite community of mutually disinterested scholars can be established through paper credentials like publications, academic position, positions in scholarly associations etc.\textsuperscript{75}

In Jones v. U.S.\textsuperscript{76} Court of Appeal in Columbia has propounded another suitable method to find out a “relevant scientific community”. In this case one of the main issues was whether the “enzyme multiplied immunoassay technique” (EMIT) tests were generally accepted in the scientific community. Citing other leading decisions in this area, Ferren J., observed:

... in determining whether a particular technique or test has general acceptance in the relevant scientific community... should, pay attention not only to expert evidence of record but also to judicial opinions in other jurisdictions that have considered the opinion, as well as to relevant legal and scientific commentaries in which the techniques or test has been scrutinized.\textsuperscript{77}

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\textsuperscript{75} To verify the said things, current publications of novel technique must be made available to the judges and they may take judicial notice of such publications. See, Adina Schwartz, “A Dogma of Empiricism Revisited: Daubert v. Merrell Dow Pharmaceuticals, Inc. And the Need to Resurrect the Philosophical Insight of Frye v. United States”, 10 Harv. J. L. & Tech. 149 (1997).

\textsuperscript{76} 548 A.2d 35 (D.C. App. 1988).

\textsuperscript{77} \textit{ibid.} at p.41. Court cited Lahey v. Kelly, 71 N.Y. 2d. 135 (in which court relies exclusively on other judicial decisions to establish required general acceptance of EMIT system) and People v. Palmer, 80 Cal. Appl. 3d 239 (relies exclusively on scientific journals to establish value and reliability of scanning electron microscope technique for gun shot evidence particle analysis).
The court further said that such outside sources might be useful in exposing a proffered expert's bias or incompetence.\textsuperscript{78} A notable significance in this case was that, no expert testimony was offered at trial by the prosecution regarding the acceptance of the EMIT test in the relevant scientific community. Regarding this court argued that a particular scientific evidence could be admitted if it is established by other courts through expert testimony or through other sources, even though no expert testimony has been offered in the trial stage.\textsuperscript{79}

The next important question regarding the determination of a relevant scientific community is, whether the testimony of a single witness alone is sufficient to represent the views of an entire scientific community regarding the reliability of a new technique. This situation may normally arise in cases where there is only a single person, who is the proponent of the technique. This question came as a main issue in a California Case, \textit{People v. Kelly},\textsuperscript{80} in which Richardson J., has observed:

Ideally, resolution of the general acceptance issue would require consideration of the views of a typical cross-section of the scientific community, including representatives, if there are such, of those who oppose or question the new technique.\textsuperscript{81}

\begin{thebibliography}{99}
\bibitem{78} Ibid. at 42.
\bibitem{79} Ibid. at 47.
\bibitem{80} 549 P.2d 1240 (Cal. 1976).
\bibitem{81} Ibid. at 1248. The facts show that the Superior Court of Orange County for the offence of extortion convicted the accused, Robert Emmett Kelly. At the time of trial, the primary evidence against the accused was the testimony of a Lieutenant Ernest Nash of Michigan State Police, who had conducted a spectrographic analysis of the anonymous calls made by the accused at the time of committing extortion. On the basis of the said examination the witness concluded that the voice collected from the extortion tapes and the accused were those came from the same person. After
\end{thebibliography}
From this statement, the issue has been clarified that before a technique or process can be accepted, something more than the bare opinion of a single person shall be insisted. This is to assure that an accurate and qualified view has been entered into the trier of fact. In United States, the ratio in this case became the law of the land.\textsuperscript{82}

Some courts suggested that while determining the relevant scientific community, courts should select the scientist who had a reasonable comprehensive understanding about the forensic issues.\textsuperscript{83} The courts insisted this additional condition, because in most of the cases in which scientific testimony was involved, a scientist having a thorough scientific knowledge will not serve the purpose, but he must have a particular forensic knowledge.\textsuperscript{84} For example, a bioscientist may

\\textsuperscript{82} The ratio in \textit{People v. Kelly} has been later followed by the same court in \textit{People v. Leahy}, 882 P.2d 321 (Cal. 1994). In this case the issue before the court was whether the results of a horizontal gaze nystagmus (HGN) field Sobriety test were admissible for establishing the offence of drunken driving. The prosecution newly introduced the said test. Therefore court held, in order to get admissible, the test should satisfy the general acceptance as provided under \textit{People v. Kelly}. The test was introduced by police officers and not by an independent scientist. Hence court said the test was insufficient to meet the general acceptance standard required by \textit{Kelly} ratio.


\textsuperscript{84} There are some differences between science and forensic science. Science is considered as a general knowledge of natural phenomena. On the other hand, forensic science is the application of the scientific knowledge in specified areas. It is a mixture of various scientific disciplines. Forensic science is mainly used for the study and examination of conditions, things and persons of unknown or disputed origin for the purpose of establishing their relationship to conditions, things and persons, which are known. Physical evidence is the substance in which forensic
have an adequate knowledge about biotechnology (applied biological science) but this is not sufficient to give evidence in a forensic DNA fingerprinting. Therefore, it is the burden of the witness who comes before court to satisfy that he had sufficient knowledge in that particular forensic issue. Otherwise the court may reject his testimony as useless. Therefore, if the disciplines like fingerprint analysis, electrophoresis, or DNA fingerprinting is on trial, theoretical scientists having a reasonably comprehensive understanding of that particular forensic science should only come before the court of law. Consistent with this view, the California court in People v. Kelly, has stated that the person who is representing a particular scientific community must be a scientist and not a technician. Court reasoned:

In considering the position of the scientific community, a court is found to let scientists speak for themselves... Although the Frye test may be satisfied by a showing of general acceptance by those scientists who are most familiar with the use of a new technique... such a showing, ordinarily, should be presented by those who are engaged in the scientific fields.

This decision shows that the court should initially determine whether the person who is coming before the court is a scientist or a technician. The reasoning of the court in this case was right because a person may get an adequate knowledge about the functioning of a particular thing through a regular

scientists are conducting examination. If certainty and accuracy is the hallmark of general science, probability is the hallmark of forensic science evidence.

549 P.2d 1240 (Cal 1976).

Ibid at 1250. See also, Norfolk S. Corp. v. Chevron U.S.A., Inc., 279 F. Supp. 2d 1250 (11th Cir. 2003) (The party tendering the expert has the burden of proving admissibility of the testimony by a preponderance of the evidence).
training or use, but it cannot be taken as a qualification similar to that of a scientist, who is engaged in a scientific field.\textsuperscript{87}

Moreover, there is a suggestion that taking of "judicial notice" of a scientific or technical fact may be helpful for identifying a relevant scientific community.\textsuperscript{88} A court can take judicial notice through independent enquiry without depending on a formal trial process.\textsuperscript{89} For that, a court may use the regular scientific literature, previous judicial decisions, evidence taken in a previous case, testimony of an expert witness etc. Thus in \textit{People v. Rogers},\textsuperscript{90} court judicially noticed the issues regarding the acceptance and reliability of voice print identification from previous judicial decisions\textsuperscript{91} as well as referred scientific literature\textsuperscript{92} and held, the said identification technique has reached the level of general acceptance.\textsuperscript{93}

\textsuperscript{87} In the said case the expert witness was only a technician for the voice identification unit of the state police force and not a scientist. However, he was allowed to testify as a technician and as a scientist to show that the voice print technique is reliable and gained acceptance in the scientific community. But court strictly states that the wide technical experience itself was not enough to say that a particular technique has gained general acceptance in the scientific community (at p.1250).

\textsuperscript{88} See, Morgan, "Judicial Notice", 57 \textit{Harv. L. Rev.} 259 (1944); Davis, "Judicial Notice", 55 \textit{Colum L. Rev.} 945 (1955); Wigmore, \textit{Evidence} (3\textsuperscript{rd} ed. 1940), pp.2565-2583. Judicial Notice can be used not only for identifying the scientific community but also to resolve the specific scientific issue.

\textsuperscript{89} Harold L. Korn has stated that while taking judicial notice the court is not restricted the evidence adduced by the parties and spread upon the trial record, nor is its investigation fettered by the rules of evidence. This makes clear that for taking notice court may go to any extent. See, Harold L. Korn, "Law, Fact, and Science in the Courts", 66 \textit{Colum L. Rev.} 1080 at 1089 (1966).

\textsuperscript{90} 385 N.Y. S. 2d 228 at 237 (Sup. Ct 1976).

\textsuperscript{91} Court cited, Hodo v. Superior Court, 30 Cal. Appl. 3d at 790-791.

\textsuperscript{92} Court quoted, Moenssens, Moses and Inbau, \textit{Spectrographic Voice Identification, Scientific Evidence In Criminal Cases} (The Foundation Press, Inc., 1973), Chapter 12, pp. 508-509.

\textsuperscript{93} 385 N.Y. S. 2d 228 at 237 (Sup. Ct. 1976).
In *People v. Palmer*, court entirely depended on scientific literature. The facts reveal that the trial court for second-degree murder of her husband convicted one Trudie Beatrice Palmer. The police officer found a pistol in the crime scene. The prosecution’s criminalist, test fired the pistol, using ammunition found in the pistol and examined minute particles obtained from his hand as well as particles obtained from the hands of the husband and dependant. For examinations, he used a scanning electron microscope. At the time of trial he testified that the particular pistol had fired the fatal shot and the particles found on the defendant’s hand appeared to be identical with gun shot residue particles found on the criminalists’ own hand. Based on this evidence trial court convicted the accused. The case came before the appeal court regarding the admissibility issue of the examinations made by a scanning electron microscope. The court found that there are no reported cases dealing specifically with the admissibility of this test. Therefore, court referred some scientific journals in which the admissibility of this technique has been specifically provided. From the said journals court noticed that the said test was reliable and definite in identifying the gun shot residue particles. Considering the said literature court affirm the conviction given by the trial court.\(^\text{95}\)

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\(^{94}\) 80 Cal. App. 3d 239.

\(^{95}\) Regarding this issue (judicial notice) Professor Giannelli has stated that, if a literature demonstrates a particular scientific issue then the duty of the court is only to go through these available scientific literatures for general acceptance. There is no need to get the testimony of some experts on that field. At the same time the opposite party can challenge the views in the scientific literature and can give explanation why the literature is not persuasive evidence of lack of general acceptance. See, Paul C. Giannelli, "The Admissibility of Novel Scientific Evidence: Frye v. United States, a Half-Century Later", 80 Colum. L. Rev. 1197 at 1218 (1980).
(B) "Falsificationism" as a Criteria in Identifying Junk Science

The majority of courts in United States for admitting the novel scientific evidence have followed Frye test. However, some decisions lately pronounced have identified certain difficulties in applying the Frye's "general acceptance standard." Frye has provided only a single criterion through which the entire scientific evidence had to pass to cross the legal threshold. The Censor Board constituted under Frye, judges were acting only as spectator without evaluating the evidence that came before them. This was considered as a serious distortion in admitting novel scientific evidence. The other reason given by commentators for the junk science problem was the judge's inability in evaluating the novel scientific evidence, as scientists themselves use in evaluating each other's work. In this part, attempt is made to evaluate certain standards used by the scientific men in evaluating their own works and work of the fellow scientists, and how it can be practically adapted in the legal context.

In the judicial history, it was in Daubert v. Merrell Dow Pharmaceuticals, Inc. for the first time United States Supreme Court identified the reason for

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96 For example, see, Jones v. United States, 548 A.2d 35 (D.C. 1988); People v. Kelly, 549 P.2d 1240 (Cal. 1976); People v. Leahy, 882 P.2d 321 (Cal. 1994).

97 In People v. Collins, 405 N.Y.S. 2d 365, 368 (Sup. Ct. 1978), Court feels difficulty in defining the community and identifying the field in which the underlying principle falls; similarly in United States v. Zeiger, 350 F. Supp. 685, 687 (D.D.C.), court felt difficulty in determining whether the principle has been generally accepted by members of the identified field; In some other cases court felt difficulty to identify a single academic discipline in which a particular technique would fall, because the person developing a novel test in one discipline may overlap in other disciplines.

98 The cases in which Frye ratio was applied, the evaluating function was done by the scientists themselves and not by judges. Judges will accept the evidence at its face value, if a scientist in the particular community once evaluated it.


100 Supra n.34.
the defects in understanding law science problems. Justice Blackmun for the majority said:

... in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested. Scientific methodology today is based on generating hypothesis and testing them to see if they can be falsified, indeed, this methodology is what distinguishes science from other fields of human inquiry... The statements constituting a scientific explanation must be capable of empirical test... The criterion of a scientific status of a theory is its falsifiability, or refutability or testability.\(^\text{101}\)

In this case court identified "falsifiability" as the know-how used by scientists for evaluating the validity of a scientific discovery. This know-how is the speciality of science by which scientific discipline can be distinguished from other disciplines. Here it is worthwhile to explain the underlying theory of falsifiability. One of the distinguished features of science from other disciplines is its testability. A scientific discovery can be subjected to empirical testing to evaluate its validity. Through this testing, most scientists believe that a scientific discovery can be proven false. In legal context, the theory of "falsifiability" came from the works of Karl Raimund Popper. He has stated that the criterion of the scientific status of a theory is its falsifiability or refutability or testability.\(^\text{102}\) Here it is important to discuss the Popperian theory of falsifiability.

\(^{101}\) Ibid. at 483. This statement was a mixture of quotations taken from two treatises. They are, C. Hempel, Philosophy Of Natural Science (1966), p.49 and K. Popper, Conjectures And Refutations: The Growth of Scientific Knowledge (5\(^\text{th}\) ed. 1989), p.37.

According to Popper, the primary task of epistemology is to solve the problem of demarcation. He says, the theory of knowledge is to answer, when should a theory be ranked as scientific? Or is there a criterion for the scientific character or status of a theory? To Popper “falsifiability” is the solution to the problem of demarcation. In contrast to other philosophers, Popper believed that science couldn’t be distinguished from pseudo-science by its confirmation by experience or observations. Regarding this Popper said:

...not the verifiability but the falsifiability of a system is to be taken as a criterion of demarcation... it must be possible for an empirical scientific system to be refuted by experience...\(^\text{104}\)

Thus in order to refute a statement it must be empirical. If it is not empirical it cannot be refuted or falsified.\(^\text{105}\) In the language of Popper, what characterizes the empirical method is its manner of exposing to falsification, in every conceivable way, the system to be tested. Its aim is not to save the lives

\(^{103}\)See, Karl R. Popper, _Science: Conjectures And Refutations_ (1965), p. 33.

\(^{104}\)See, Karl R. Popper, _The Logic_, supra n.102, at p.41, same view has also taken by F. Ayala and B. Black. They said: "...scientists consider falsifiability the most important characteristic separating science from other forms of knowledge. An explanation or hypothesis that cannot be subject to the possibility of rejection based on observation or experiment cannot be regarded as scientific... Testing is accomplished by preparing what should be observed if the hypothesis is correct and then seeing if the predictions accord with what is actually observed. Any meaningful test can result in the falsifying of a hypothesis and it is only when a hypothesis survives such efforts at falsification that it becomes corroborated and accepted". This is not their independent view, but a supportive statement to the Poppers project. See, F. Ayala and B. Black, "Science and Courts", 81 American Scientist 234 at 236-37 (1993).

\(^{105}\)The word “empirical” as seen in the Webster’s Ninth New Collegiate Dictionary (1988) means something capable of being verified or disproved by observation or experiment. For example, a statement that ‘it will rain or not rain here tomorrow’, cannot be regarded as empirical, whereas a statement that ‘it will rain here tomorrow’ can be regarded as empirical statement. Thus either in the case of testability or falsifiability, a novel scientific discovery must be suitable to the process of empirical analysis. If it is not amenable to this process then it is not scientific.
of untenable systems but, on the contrary, to select one which is by comparison the fittest, by exposing them the entire fiercest struggle for survival.

(i) What is Falsifiability?

Popper defined the term falsifiability. According to him, a theory can be called "empirical" or "falsifiable", if it divides the class of all possible basic statements unambiguously into the following two non-empty subclasses. First, the class of all those basic statements with which it is inconsistent (or which it rules out, or prohibits) one may call this the class of potential falsifiers of the theory; and secondly, the class of those basic statements which it does not contradict (or which it permits).

For Popper, "falsifiability" is synonymous with "refutability" or "testability". For Popper, "falsifiability" is synonymous with "refutability" or "testability". As quoted in Daubert, Popperian falsifiability means:

A system is to be considered as scientific only if it makes assertions, which may clash with observations; and a system is, in fact, tested by attempts to refute it. Thus testability is the same as refutability, and can therefore likewise be taken as a criterion of demarcation.

The working process of Popperian falsification was clearly described by Gary Edmond and David Mercer as follows:

The building block of science is the critical test. The source of scientific hypothesis is irrelevant as long as scientists are able to frame such hypothesis in terms that leave them logically open to being shown to be false. These hypothesis (conjectures) should also be framed in the most

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107 Ibid. at 33-37.
specific testable terms possible. The bolder and more open to test it is, the better the conjecture. A further demand on the discipline of the scientist was to adopt the appropriate critical attitude and avoid developing emotional commitment to theories. Even one single falsifying observation should be sufficient for the rejection of a well-established theory. As far as possible, devices like adhoc hypothesis or temporary suspension of criticism, even toward part of a theory, were forbidden. Out of this critical process of trial and error certain testable theories survive attempts at falsification. These become the most certain knowledge of that particular time—but because science is an open-ended enterprise even these theories, as robust as they might seem, are open to future testing and future rejection.\textsuperscript{108}

From the above passage it is clear that every scientific theory or technique must pass the line of critical test, then only it can be considered as proper. Popper's view was that lack of falsifiability makes science a "closed" static knowledge system. It cannot progress or provide any explanation beyond what is already known, and cannot be regarded as a true science.

Popper has also stated that a conclusive classification of a theory is impossible. "No conclusive disproof of a theory can ever be produced; for it is always possible to say that the experimental results are not reliable, or that the discrepancies which are asserted to exist between the experimental results and

the theory are only apparent and that they will disappear with the advance of our understanding.\textsuperscript{109}

(ii) Criticism of the Popperian Theory of Falsificationism

Popperian theory of falsifiability is not beyond criticism. Various writers strongly criticized Popper.\textsuperscript{110} Among them Carl G. Hempel was the person who strongly criticized Popper. Hempel in his work, Philosophy of Natural Science,\textsuperscript{111} argued that the Popper's testability couldn't be taken as an adequate criterion for distinguishing between "Science" and "Pseudo science" or demarcating science from metaphysics. He argued that neither confirmation nor falsification by experience could be developed to yield the requisite sharp divide between sentences.\textsuperscript{112} In order to prove these things he made an analysis with the test of verifiability and falsifiability. In the view of Hempel, the verifiability criterion defines a sentence ‘S’ as empirically meaningful or scientific if and only if it is capable in principle of being completely proven. Similarly he stated that the test of falsifiability criterion defines a sentence ‘S’ as empirically meaningful or scientific if and only if it is capable in principle of being completely disproven. According to him in both cases, if it is consistently applied, some of the most important sentences of empirical science count as empirically meaningless or metaphysical. The universal statements or general laws are the limitations to both verifiable and falsifiable techniques.\textsuperscript{113} As an example, he states that, how

\textsuperscript{109} Karl R. Popper, The Logic of Scientific Discovery (1968), pp. 42, 50.


\textsuperscript{111} Ibid.

\textsuperscript{112} Ibid. at p.102. For more details about Hempel's Criticism see, Adina Schwartz, "A Dogma of Empiricism" Revisited, supra n.75.

\textsuperscript{113} See, Ibid. at 104-105.
many times we observe the sun rising, it remains possible that the sun may not rise tomorrow. Hence, Hempel opined that it is not possible to achieve a rational and clean demarcation between science and pseudo-science.

Moreover, according to Hempel, in a verifiability or falsifiability criteria there will be two types of sentences. One sentence itself is to be tested and the other will serve as a test. The sentence that will act as a test will in most cases be “theory-laden”. Therefore, such sentences that are supposed to serve as the test are themselves in need of testing.114 A similar view has also been taken by Gary Edmond, who says that a theory cannot be conclusively falsified because attempts at falsification rely on observations, which are fallible and open to revision and thus the problems with induction remains.115 Similarly, the observation statements that form the basis of the falsification may themselves prove to be false in the light of later developments.116

Gary Edmond and Mercer also relied on the strictness of falsification criteria to criticize it. They argued that falsification criteria are so strict, and it may even deny the development and acceptance of many major scientific theories.117

The language of Daubert judgement118 shows that while interpreting the Federal Rules of Evidence, the intention of the majority was to introduce a liberal rule, as a relief from the clutches of Frye’s general acceptance standard. At the same time court feared in fully liberalizing the admissibility criteria of scientific

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114 Ibid. at 107-118.
116 Ibid.
117 Ibid. at 87.
118 Supra n.34, at 479.
Hence, court introduced the standard known as the "falsification" as criteria in admitting scientific evidence. In reality, the Daubert decision represents a potential revolution by introducing a new criterion for admitting scientific evidence. However, in result the standard prescribed by the Daubert Court is very rigorous. If it is applied as such, it may result in the relegation of various forensic scientific evidences.\footnote{Ibid.}

By adopting the theory of falsifiability, what Daubert court intends, was to insist "objectivity" as the basis of every scientific methodology. If an expert's methodology cannot be explained in objective terms and is not subject to be proven incorrect by objective standards, then the methodology can be said to be unreliable. The court was of the view that scientific expert testimony cannot be evaluated on subjective basis. Whatever the consequences that Popperian project has made out, it is respectfully submitted that every theory has its own

\footnote{Here one has to consider the difference in the application of "falsificationism" as criteria in legal truth finding and scientific truth finding. In reality, both law and science are searching for truth. For that they have also developed their own procedures. But in the case of interdisciplinary matters both disciplines had to sacrifice little procedural formalities in order to accommodate the other. This is almost due to the dissimilarity of application in both disciplines. The law's concept of truth is different from science concept. As a social science, law is deeply indebted to social norms than science. The result of a scientific research may come in adverse to the society, but it is inconceivable in law. Therefore, law has certain other concerns beyond scientific truth finding. Similarly, in Science "Certainty" is the foundation stone of a scientific truth finding. But this cannot be taken as obstinacy in law because legal truth finding is almost based on probabilities. For example, in a criminal case what law requires from prosecutors is only a proof "beyond reasonable doubt" and not certainty. If certainty is used in legal truth finding no suit can be settled finally. Therefore, law uses its own parameters, different from science, to find truth. The law may exclude the matters, which scientists might regard as the best evidence, for reasons of policy. Therefore the application of "falsifiability" in legal truth finding has limitations. It cannot be used in law as it is used in scientific truth finding. For more details see, A. Febrajo and D. Nelken, "The Truth About Laws Truth" in Milan (ed.) The European Year book For Sociology of Law, (1993), p.87; Michael Freeman and Helen Reece, Science in The Court (Ashgate Publishing Co., 1998), p.4, "A Proposed Science Court", 75 Mich. L. Rev. 1062 (1977); see also, the ratio of the United States Fourth Circuit Court in U.S. v. Baller, 519 F.2d 463 (C.A.W. Va. 1975). In this case court said, "absolute certainty of result or unanimity of scientific opinion is not required for admissibility".}
merits and demerits. Popper's work on falsifiability can be considered as one of the suitable methods for screening scientific evidence. Presently it is not possible to say, to what extent it may go in achieving that particular purpose. The project can be used at least as a gatekeeper in the evidence threshold.

(C) Role of Precedents in Determining the Standards for the Admissibility of Scientific Evidence

The unexpected advancement of scientific evidence and its encroachment into the legal scene has made judiciary in dark. The main issue is regarding the admissibility of scientific evidence. In an adversarial system, accurate scientific fact-finding and at the same time procedural fairness is the goal of our legal system. To achieve these goals, law has placed a more broad based kind of scrutiny than it has traditionally used. Law in screening scientific evidence that comes before the court of law used various methods. Among them precedents have played an important role in formulating standards for the admissibility of scientific evidence. This part reviews the role of precedents as a tool in evaluating scientific evidence.

In almost all legal systems, especially in United States and United Kingdom, they have developed rules regulating the admissibility of scientific evidence. The threadbare analysis of these rules will show that legal system

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has developed these rules to overcome the junk science problem. This part separately discusses the standards of admissibility provided by judicial decisions in different jurisdictions.

(I) Precedents Determining the Standard for Admissibility of Scientific Evidence in United States: Reliability as a Criterion for Admissibility

In United States, the first step for a special rule for the admissibility of scientific evidence was originated in 1923, by the pronouncement of the path breaking decision, Frye v. United States. Before 1923 the expert's testimony was admitted considering their face value. The only thing that court considered at that time was whether a particular expert was qualified. If a person was qualified to be considered as an expert then his opinion testimony was entitled to be admitted as evidence. But at that time an expert's opinion was admissible only if the judges were incapable to decide the subject matter in dispute. Similarly, expertise was implied from the expert's success in an occupation or profession, which embraced that knowledge. The presumption at that time was, if a person could make a living, selling his knowledge in the market place, then there was expertise in him. The value of an expert's knowledge was determined in accordance with the commercial value it had in the open market. The expert's knowledge was kept for hire and a buyer would have opportunity to access and compare the knowledge. Thus the standard of admissibility in the early period of legal history was in a pathetic condition.

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124 Supra n.69.


126 This was the prominent method used by the parties in selecting experts for their issues.
An interesting example of this condition was the admissibility of scientific evidence by the Supreme Court of Wisconsin in *Magnuson v. State*.

The significance of this case was that the accused was convicted for the charge of murder, relying on a mass of scientific evidence. The facts show that a bomb was sent through mail to the victim and upon its receipt he opened the package, leading to an explosion, which caused the death of one person and serious injury to another. The only clue in this case, which the police had, was the remains of the bomb and fragments of the paper-wrapper containing the address. For finding out the owner of the letters in the address, police had consulted one examiner of questioned documents. He suggested that the spelling of the town address (Marsfilld for Marshfield) was characteristic of a person familiar with the Swedish language. By the help of this opinion police found the only Swede in the vicinity who had enmity toward the victim. He was one John Magnuson (defendant).

Other proof was made from the pieces collected from the crime scene. With those pieces a bomb was reconstructed and it was found that, the bomb was made with a hollow of white elm, a piece of gas pipe, a brass tube and a small piece of steel used as trigger. After that, the defendant’s premises were inspected and pieces of gas pipe, brass bubbling, bottle of ink, saw dust and shavings were found on the workbench. These were the evidences in this case.

In the trial stage further test mony was given by an expert establishing the fact that a fountain pen with a round point had been used similar to that found in the defendant’s house and that the ink used to address the package gave the

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127 203 N.W. 749 (Wis. 1925).
128 Ibid. at 750.
same chemical reaction as that found in the fountain pen. A botanist from the
U.S. Forest Service Laboratory testified that the sawdust taken from the
defendant's workbench was of white elm collected from the victim's home.\textsuperscript{129}
Testimony of an expert was also given regarding the fact that the trigger on the bomb
came from the same piece of steel as the trigger taken from the defendant's gas
engine.\textsuperscript{130}

The court admitted all evidence without determining the reliability of the
tests or analysis conducted by the scientific experts. The Wisconsin Supreme
Court also approved the same. The observation of the Supreme Court regarding
this is amazing:

We have, however, set out the evidence with greater particularity than
would ordinarily be warranted under such circumstances, because it
discloses what may be done by a diligent prosecuting officer who has an
intelligent comprehension of the things that are necessary to establish guilt
in a case of this importance. The guilt of the defendant is as conclusively
established, as it is possible for it to be. It is scarcely conceivable that any
jury could find otherwise than did the jury in this case.\textsuperscript{131}

If one considers the nature of evidence adduced in this case and the
appreciation given by the court for that, one can conclude that this is the

\textsuperscript{129} \textit{Ibid.} at 751.

\textsuperscript{130} \textit{Ibid.} at 752. The conclusion was based on the analysis made by the expert by
examining the crystalline structure and formation of the two pieces of metal. For that
the crystal grains of the metal were taken and magnified and photomicrographs were
taken. This analysis showed that the trigger from the bomb had the identical crystals
and formation that collected from the defendant's gas engine. In order to prove the
reliability of the technique, different pieces of steel were taken at random and
photomicrographs were taken to show how the pieces differ. Photomicrographs are
used to determine the tool in issue.

\textsuperscript{131} \textit{Ibid.} at 753.
maximum pain, which was taken by a fact finder in determining the reliability of scientific evidence in that period.

(i) Frye Test

A major break-through was occurred in the United States jurisdiction after the pronouncement of the Court of Appeals decision, Frye v. United States.¹³² This decision was the milestone in the development of the modern United States law governing admissibility of scientific evidence. Later this case became the dominant test for the admissibility of scientific evidence in Federal and State Courts.

The facts of the case were that one James Alphonzo Frye was charged and convicted of Murder by the Supreme Court of the District of Columbia. He preferred an appeal before the Court of Appeal of District Court of Columbia, showing a single assigned error committed by the trial judge. The error was regarding the rejection of novel scientific evidence, "Systolic blood pressure test", a forerunner of the polygraph test. In the course of trial the defendant through an expert witness offered the result of this test. The expert explained that the blood pressure is influenced by change in the emotions of the witness, and that the systolic blood pressure rises are brought about by nervous impulses sent to the sympathetic branch of the autonomic nervous system. He claimed that when a person is under the examination of this test, the conscious deception or falsehood in his mind, concealment of facts, or guilt or crime, accompanied by fear of detection will raise the systolic blood pressure in the curve, which corresponds exactly to the struggle going on in the subject's mind, between fear

¹³² Supra n.69.
and attempted control of that fear as the examination touches the vital points in respect of which he is attempting to deceive the examiner.\textsuperscript{133}

On appeal Frye raised the traditional rule\textsuperscript{134} governing expert testimony. But the Court imposed a new standard instead of applying the traditional rule. This new rule was known as the "general acceptance" test which means that expert scientific evidence should not be deemed admissible unless and until the methods and principles in which it was based achieved widespread acceptance in the relevant discipline. Van Orsdel A.J., handed down the judgement for the court. He reacted as follows:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in the twilight Zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.\textsuperscript{135}

\textsuperscript{133} \textit{Ibid.} at 1013-14. This test was based on the theory that truth is spontaneous, and comes without conscious effort while the utterance of a falsehood requires a conscious effort, which is reflected in the blood pressure. The rise thus produced is easily detected and distinguished from the rise produced by mere fear of the examination itself. In the former instance, the pressure rises higher than in the latter, and is more pronounced as the examination proceeds, while in the latter case, if the subject is telling the truth, the pressure registers highest at the beginning of the examination, and gradually diminishes as the examination proceeds. \textit{Ibid.} at 1014.

\textsuperscript{134} The traditional rule was based on the requirements of relevancy and helpfulness to the trier of fact.

\textsuperscript{135} \textit{Supra} n.69, at p.1014.
Applying this rule, court held that the deception test lacked the requisite standing and scientific recognition among psychological and physiological authorities.\textsuperscript{136}

Thus, \textit{Frye} test envisions an evolutionary process leading to the admissibility of scientific evidence. It differentiates scientific evidence from other evidence.\textsuperscript{137} \textit{Frye} has established a procedure to be fulfilled before taking judicial notice of a novel scientific theory or technique. \textit{Frye} mandates that a novel technique must pass through an experimental stage in which the scientific community scrutinizes it. Only after the technique has been tested successfully in this stage and has passed into the demonstrable stage it will receive judicial acceptance. \textit{Frye} imposes a special burden that the "relevant - scientific community" must generally accept the technique. Thus through this statement, \textit{Frye} had delegated the burden of evaluating complex scientific merits, from judges to the scientists who are eminent in the particular discipline. Therefore, it makes easy for judges to evaluate the novel scientific discoveries with little scientific knowledge. The philosophy behind this new rule lies in the fact that \textit{Frye} recognizes the social character of human knowledge in general and science in particular.\textsuperscript{138} Thus \textit{Frye} judgement put forward the simplest test for the judicial community, allowing judges to function while dealing with scientific matters without confusion of scientific questions.

\textsuperscript{136} \textit{Ibid.} at 1014.


\textsuperscript{138} See, Adina Schwartz, "A Dogma of Empiricism Revisited, \textit{supra} n.75."
(ii) Philosophy of Frye Ratio

The underlying philosophy of Frye ratio is based on the fact that the Frye court has taken a "realistic approach" regarding the admissibility of scientific evidence. The court recognized the distinction between "Scientific reliability" and "legal reliability". By making acceptance by the relevant scientific community, what Frye court recognized was, that the testing of scientific reliability within the scientific field is something more than the testing of scientific reliability within the legal context. Basing this proposition, some commentators has rightly stated that deference to scientists is the only rational basis for judicial determinations of the scientific merit of preferred evidence. In this line Paul S. Milich in his article has noted as follows:

Science is the only source of its own reliability. Anything less than complete deference to the weight of credible scientific opinion concerning the reliability of scientific evidence means going outside science. The resulting judgement cannot be scientific and therefore we cannot honestly speak of the evidence as having "Scientific" reliability.

Here it is submitted that if this standpoint is taken as a reason for delegating the screening role of judges to the scientists, one can say that it will be a complete deference to the scientific community. However, this will not make any distortion in the legal discipline. Evaluation of scientific reliability is

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139 See, Ibid. at 196; see also, Paul S. Milich, "Controversial Science in the Court Room: Daubert and the Laws Hubris", Emory L. J. 913 (1994).
140 Ibid. at 923-24 Milich, Controversial Science.
141 Same stand has also taken by some others. See, Note, "Improving Judicial Gate Keeping: Technical Advisors and Scientific Evidence", 110 Harv. L. Rev. 941 (1997). This is inevitable because the ability of juries and judges in resisting the overwhelming of complex scientific evidence has been questioned in many situations. The unreliable and junk theories may misleading the jury and lead him to accept it without critical scrutiny. See, e.g., Giannelli, supra n.95, at 1237.
different from legal admissibility. While evaluating a scientific technique, scientists are considering the merits of that technique within their own field. By doing so they are not intruding the legal field. Similarly, if the professionals in that field have answered a scientific question, does not make it admissible in the legal field. The courts are free to check its relevance and admissibility. Therefore, as Frye observes, deference to a "relevant scientific community" is the only proper way by which court can assess the scientific merit of a theory or technique.

Since Frye, the principle of "general acceptance" had been adopted throughout the United States Federal courts system, as well as in the majority of State courts.

Some prominent commentators in United States has stated that courts in United States were eager to adopt the general acceptance test because it did not require that judges shall understand the scientific claims at issue. However, there was a deficiency in the Frye decision. Two pages Frye decision omits to state the meaning of the principle "general acceptance". Therefore, it makes difficulty for courts in interpreting "general acceptance". Courts in different languages interpreted it. For example, the California Supreme Court has given a narrow interpretation in People v. Leahy, by saying that general acceptance means a consensus drawn from a typical cross section of the relevant, qualified scientific community. But in U.S. v. Bonds, court gave a liberal interpretation

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142 Bert Black has stated that the general acceptance language used in Frye should apply only to the underlying reasoning and methodology employed by the expert, whereas the reliability of the experts conclusion which ultimately determines admissibility should be a matter of law of the judge to decide. See, Bert Black, "A Unified Theory. supra n.42, at p.632.

143 See, "Improving Judicial Gate keeping, supra n.141.

144 882 P.2d 321at 337 (Cal. 1994).

145 12 F.3d 540 (6th Cir. 1993).
holding that general acceptance does not require acceptance by a majority of scientists in the relevant scientific community. This vagueness of Frye's general acceptance makes Frye test very difficult to apply. Despite, it was regularly applied for determining the valicity of scientific techniques like Polygraph, hypnotic and drug induced testimony, voice stress analysis, voice spectrograms, Ion microprobe mass spectroscopy, infrared sensing of aircraft, psychological profiles of battered women, blood group typing etc.

(iii) Criticism of Frye Test

Frye's "general acceptance" formula was criticised by commentators from all sides. Among them McCormick, Paul C. Giannelli and Bert Black are in the first row. Here the basis, merits and demerits of their criticism can be analysed.

Professor McCormick criticised that the doctrine of "General acceptance" is not helpful for trial judges in evaluating the admissibility of scientific evidence. He was of opinion that disagreement in the scientific community regarding the reliability of a scientific process should go to the weight rather than the admissibility of scientific evidence. Regarding this McCormick Said:

General Scientific acceptance is a proper condition upon the courts taking judicial notice of scientific facts, but not a criterion for the admissibility of scientific evidence. Any relevant conclusions which are supported by a qualified expert witness should be received unless there are other reasons for exclusion. Particularly, its probative value may be overborne by the familiar dangers of prejudicing or misleading the jury, unfair surprise and undue consumption of time.\textsuperscript{146}

\textsuperscript{146} See, McCormick, Evidence (1954), pp 362-364.
Paul C. Giannelli based his criticism regarding the difficulty in applying the principle of Frye’s general acceptance. With the help of some case laws he opined that it is difficult to identify a particular field in which an underlying principle falls. Similarly, he says that it is also difficult to determine whether members of the identified field have generally accepted the principle.

He explained the first difficulty in the selection of an appropriate field with the help of People v. King. He says that many scientific techniques do not fall within the domain of a single academic discipline or professional field. Therefore, selecting an appropriate field is troublesome. In the said case, voice print technique came before the court seeking admission. Applying the Frye’s general acceptance standard court tried to identify the relevant scientific community of the particular technique. The court found that the communication by speech does not fall within any one established category of science. The field of voice print technique was scattered in many disciplines like anatomy, physiology, physics, psychology and linguistics. In this case court rejected the opinion of an expert produced before the court as the developer of the said technique, on the ground that he was not knowledgeable in all the above said disciplines.

It is submitted that the criticism has no base. Anyone can agree with the fact stated by Giannelli that some techniques may not fall in a single academic discipline. But in order to satisfy the Frye’s general acceptance test this threadbare analysis of a scientific technique is not necessary. Almost all-scientific technique may come in court through forensic scientists. One of the

147 Paul C. Giannelli, supra n.95 at 1208.
149 Ibid. at 456.
150 Ibid. at 450.
significance of forensic science is that it is a discipline having self-sufficiency. A forensic scientist who is coming with a new technique is presumed to have knowledge about everything relating to his technique. He will be a master of that technique. Moreover, cases are concerned only with the forensic application of a particular technique. Here forensic scientists cannot apply a technique without proper theoretical basis. Hence, Frye's general acceptance test can satisfy by calling a forensic scientist who had a thorough basis regarding the technique.151

Another difficulty pointed out by Giannelli was regarding the finding of general acceptance of a particular technique in a scientific community. The reason given by him for this criticism was that there is no specific percentage delineated by the Frye court to find out the general acceptance in a scientific community.152 It is submitted that this criticism is also not maintainable because it has been well accepted that the finding of general acceptance is a quite easy method than evaluating the complex scientific techniques by non-scientists. If a relevant scientific community has been identified, general acceptance can be easily established by considering the opinions given by an independent and impartial expert or from scientific or legal writings other than those written by the proponent or his supporters of a technique.

151 A forensic application of a scientific technique is different from its theoretical science. In order to testify a scientific theory, a theoretician is enough but in the case of its forensic application the person must come from that discipline. For example, to determine the validity of a forensic DNA analysis, the scientists who are focussing on DNA profiling in the forensic setting is enough. It is not necessary to call scientists from Biology, Biotechnology, Biochemistry and Physics. A scientist focussing on DNA profiling will be capable to say every thing regarding his technique. Analysing interdisciplinary approaches may make more confusion. Giannelli himself has stated in his same writing that the successful application of a new technique will prove the validity of the underlying theory or principle. See, Paul C. Giannelli, supra n.95, at 1212.

152 See, Ibid. at p. 1210
Bert Black\textsuperscript{153} concentrated his criticism regarding the application of Frye test. According to him Frye gave more power to judges in delegating their function of evaluating the admissibility of scientific evidence to the scientists.\textsuperscript{154} He says that the general acceptance test of Frye should be limited in evaluating the underlying reasoning and methodology employed by an expert, and the determination of the reliability of a conclusion reached by an expert from his reasoning's or methodology, should remain in the hands of judges.\textsuperscript{155} He claims that from the experience, courts were applying the general acceptance test to both methodology and conclusion. In his opinion this complete deference may result in the dictatorship of scientists.

Black's criticism is not sustainable because it is a deliberate argument against reality. The main argument in his criticism is that evaluation of the conclusion of an expert should be a matter of law for the judge to decide. Practically this is not possible because judges have relinquished their power to the scientist due to their inability in evaluating the reliability of a scientific technique. Evaluation of a scientific technique includes the conclusion. Conclusion cannot be separated from an experts reasoning and methodology. It has no independent existence different from a methodology. It is the essence derived from a scientist's methodology. Black misconceived the evaluating process of a scientist in checking reliability as law's admissibility. Scientific reliability is different from law's admissibility.\textsuperscript{156} If a

\begin{footnotesize}
\begin{enumerate}
\item Bert Black, "A Unified Theory, supra n.42.
\item Ibid. at 632.
\item Ibid. at 629-31.
\item In a recent case Guerre-Chaley v. State, 86 P.3d 539 (9th Cir. 2004) (Court explained the term scientific reliability. Court said, the reliability of a scientific test or procedure refers to the degree of uniformity in the results, i.e. the likelihood that the test or procedure will repeatedly yield the same results under the same testing conditions).
\end{enumerate}
\end{footnotesize}
scientist had evaluated scientific reliability of a technique, law has its own time and procedure to check its admissibility.\textsuperscript{157}

Nevertheless, \textit{Frye} decision has some shortages. The main defect in the \textit{Frye} decision was that court did not define the principle of general acceptance. Later this makes confusion to the courts, which followed the principle.\textsuperscript{158} Courts interpret the principle in a different language. Similarity, in the \textit{Frye} Case, court did not refer to any scientific literature or expert's testimony to determine the reliability of the "Systolic blood pressure test".\textsuperscript{159} In this case the device was used by the accused to prove his innocence. Therefore it was the duty of the court to check the legality of that proof. Court ought to have evaluated the validity of the scientific device used in this case by the help of a scientist in the particular scientific community. This was another drawback of this case. The other important limitation of the \textit{Frye} test is that it is applicable only to "novel scientific evidence".\textsuperscript{160} However, \textit{Frye} test had survived more than seventy years.

\textsuperscript{157} By evaluating the reliability of a scientific technique, a scientist is not usurping the function of a judge. In the language of Wigmore, a scientist could not usurp it if he would, because the jury may still reject his testimony and accept his opponent's and no legal power, not even the judge's order can compel them to accept the witness statement against their will. See, Wigmore, \textit{Evidence} (3\textsuperscript{rd} ed. 1940), p.795. Therefore, Black's contention that the power given to the scientists shall empower them to decide what evidence should be heard in the courtroom is baseless. Whatever the opinion of an expert scientist, after evaluating the entire process of a scientific technique, it is the words of a fact finder that becomes final.

\textsuperscript{158} \textit{Frye} decision is a two-page decision having no explanation regarding its "general acceptance" principle. This creates difficulty in its application.

\textsuperscript{159} See, \textit{Frye v. United States}, Supra n.69, at p.1014.

\textsuperscript{160} Recently in \textit{State v. Lucero}, 85 P.3d 1059 (9\textsuperscript{th} Cir. 2004) (Court held a \textit{Frye} hearing is not required every time, scientific evidence is offered. A \textit{Frye} determination is required only for novel or experimental scientific evidence. It is therefore not necessary to subject evidence to a \textit{Frye} analysis if the evidence does not rely on novel scientific principles or techniques) (at p.1061). Similarly, \textit{Frye} test is applicable only in scientific expert testimony and not non-scientific expert testimony. Thus in \textit{Minor v. State}, 2004 Ala. Crim. App. LEXIS 156 (Court held, the \textit{Frye} test applies only to the admissibility of novel scientific evidence based on scientific tests or experiments).
After 1950, courts realised that the *Frye*’s “general acceptance” test was very conservative and difficult in application.\(^{161}\) *Frye* put the scientific evidence in a separate compartment from other forms of evidence.\(^{162}\) Commentators opined that this classification makes evidence appreciation difficult. Some others state that *Frye*’s stringent standard threatens to exclude reliable and relevant scientific evidence due to its novelty and lack of its wider general acceptance in the scientific community. This was resulted in the exclusion of various relevant and path-breaking scientific innovations.\(^{163}\) These and other reasons ignite new ideas in the minds of scientific and legal luminaries to overcome the *Frye*’s defects.

As a first step, Professor McCormick formulated a new approach known as the relevancy approach. He states that *Frye*’s general acceptance standard is only a proper condition for taking judicial notice of scientific facts and not a suitable criterion for the admissibility of scientific evidence.\(^{164}\) In his view any relevant conclusions supported by a qualified expert witness should be received unless there are distinct reasons for its exclusion.\(^{165}\) Thus the relevancy

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\(^{161}\) Some courts decline to follow the *Frye*’s general acceptance test in behavioural sciences like battered woman syndrome and rape trauma syndrome. They reasoned that *Frye*’s general acceptance standard has traditionally been applied in novel scientific devices involving the evaluation of physical evidence and not in psychological evidences. Thus they advanced a distinction between these two evidences. See, "Confronting the New Challenges of Scientific Evidence", 108 Harv. L. Rev. 1481 (1995). Other major drawback of *Frye* test was its divergent use. There was no uniformity in the application of the test. This creates confusion in the judge’s mind and they applied the test according to their whims and fancies. For more details about *Frye*’s drawbacks see, David L. Faigman, Elise Porter and Michael J. Saks, "Scientific Evidence After the Death of *Frye*: Daubert and its implications for Toxic Tort, Pharmaceutical and Product Liability Cases – Exploring the Past, Understanding the Present and Worrying about the Future of Scientific Evidence", Cardozo L. Rev. 1799 (1994).


\(^{163}\) Almost all novel scientific innovations can be excluded from the admissibility threshold by using this standard. This may even affect the developments in forensic science.

\(^{164}\) McCormick, *Scientific Evidence* (3\(^{rd}\) ed.). p. 608.

\(^{165}\) *Ibid.*
standard, which closely connected with the procedural aspects of evidence, says that the disputes over reliability shall only affect the weight and not the admissibility of the evidence.\textsuperscript{166}

The leading case, which was decided in the line of McCormick's relevancy standard, was Coppolino v. State.\textsuperscript{167} In this case court ignored Frye's general acceptance standard and admitted novel scientific evidence. The fact of this case is interesting. The Circuit Court of Collier County tried one Carl Coppolino for the murder of his wife. Carl Coppolino was an anaesthesiologist who has been regularly working with a drug known as Succinykholine Chloride. He injected this drug on his wife's body which resulted in her death.\textsuperscript{168} The significance of this drug is that it will cause cessation of breathing in the absence of artificial respiration. The post-mortem examination could not detect any injuries except a needle tract in her left buttock. The doctor who conducted the post-mortem collected some tissue from her buttock and sent it for toxicological analysis. The toxicologist conducted standard tests. He found no drugs or poisons in the tissue. Later, the toxicologist developed a new test for detecting abnormal amounts of the drug succinykholine chloride.\textsuperscript{169} Any scientists before this case never conducted the same test. Both defence and prosecution experts testified that prior to the performance of this test it was believed that it was impossible to demonstrate the presence of succinykholine chloride or its component parts in the body. Hence this novel test became the admissibility issue.

\textsuperscript{166} See, Paul. C. Giannelli, \textit{supra} n.95 at pp.1233-34.
\textsuperscript{167} 223 So.2d 68 (Fla. App. 1968).
\textsuperscript{168} \textit{Ibid.} at 69-70.
\textsuperscript{169} \textit{Ibid.} at 69.
After analysing the tests of admissibility including the Frye test court explained that the courts discretion in admitting evidence is wide enough to admit scientific evidence lacking general acceptance of the scientific community.¹⁷⁰ Thus in this case court admitted the new test specifically developed for the said trial despite the Frye’s general acceptance standard. The court did not give any special reason for deviating from the Frye.¹⁷¹

The above analysis makes clear that in relevancy standard no special treatment shall be given to the scientific evidence different from other forms of evidence. This test was almost relied on the adversarial process to expose weaknesses in the evidence through cross-examination or by adducing other expert’s testimony. Though, the relevancy approach often associated with McCormick, Coppolino court neither endorses it in the judgement. Critics asserted that although the relevancy test was a direct reaction against Frye, it shared one important characteristic with the general acceptance approach, which judges continued to take little or no part in screening scientific evidence.¹⁷² Some others seriously

¹⁷⁰ Ibid at 70. In this case court received the new test because it was considered as relevant to the case.

¹⁷¹ If the court applied the Frye’s general acceptance standard, then surely court will reject this new test. The Fourth Circuit Court took a similar approach in a later case U.S. v. Baller, 519 F 2d 463 (C.A.W. Va. 1975). However, in this case court has given a specific reason for deviating from the Frye’s general acceptance ratio. The main issue in this case on appeal was regarding the admissibility of expert’s spectrographic analysis for identifying voice of the accused. Rejecting the Frye’s general acceptance standard, court observed: “absolute certainty of result or unanimity of scientific opinion is not required for admissibility, unless an exaggerated popular opinion of accuracy of a particular technique makes such use prejudicial or likely or mislead jury, it is better to admit relevant scientific evidence in the same manner as other expert testimony and allow its weight to be attacked by cross-examination and refutation.” Court held, expert spectrographic analysis was admissible.

¹⁷² See. “Improving Judicial Gate keeping, supra n 141.
criticised the *Coppolino* decision as absolute wilfulness and arbitrary use of judicial power. They commented this as the negation of the law of precedent.  

(iv) *Frye Test After the Enactment of Federal Rules of Evidence*

The United States Congress enacted the Federal Rules of Evidence in 1975, providing Rule 702 to 706 exclusively dealing with expert evidence. Moreover, Rule 401 and 402 generally deal with the relevancy of evidence. Rule 402 provides that, "all relevant evidence is admissible except as otherwise provided... evidence which is not relevant is not admissible". Thus Rule 402 mandates "relevance" as the criterion for the admissibility of a particular piece of evidence. What is relevance is defined in Rule 401 as evidence, which has any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.

Rule 702 specifically deals with the admissibility of scientific evidence, which states that, "if scientific, technical, or other specialised knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill experience, training or education, may testify there to in the form of an opinion or otherwise".

Above all these provisions, Rule 403 empowers the court to exclude evidence, although relevant, if its probative value is outweighed by considerations of prejudice, confusion, or wastefulness.

In effect, the enactment of the Federal Rules of Evidence creates more confusion regarding the admissibility of scientific evidence because the Rule has taken a liberal stand different from *Frye's* rigid general acceptance requirement.

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at the same time Rules did not mention anything about the continuance of the Frye test.\textsuperscript{174}

Since the enactment of the Federal Rules of Evidence a controversy occurred in courts and amongst commentators regarding the survival of the Frye rule. Some commentators argued that due to the liberal trend taken by the Federal Rules of Evidence, Frye's rigid and conservative standard has been eliminated. The commentators, who said Frye was superseded by the provisions of the Federal Rules, exploited the omissions made by the Congress in mentioning Frye while drafting the Rules. There was also a difference of opinion between the United States Federal Courts regarding the continuance of Frye standard. Some Federal Circuit Courts held that Frye standard would continue despite the liberal provisions provided in the Federal Rules of Evidence,\textsuperscript{175} while some others rejected the Frye test.\textsuperscript{176} This makes uncertainty in applying a particular standard. Moreover, some Circuit Courts have deviated from Frye's general acceptance standard and formulated new criteria for screening scientific evidence.

\textsuperscript{174} The drafting history of the Rule makes no mention about Frye's "general acceptance". As a dominant standard, which was in existence before the enactment of Federal Rules of Evidence, the congress ought to have mention about their intent regarding Frye's status. Different from "general acceptance" standard Rule 702's requirement that the testimony must "assist the trier of fact to understand the evidence or to determine a fact in issue" shows that the Rule is primarily concerned with "relevance" standard, by demanding a valid scientific connection to the pertinent inquiry as a precondition to admissibility. Thus under Rule 702, looking relevance of the evidence in issue is the main task of a fact finder.

\textsuperscript{175} For example, Frye standard was implemented in \textit{People v. Kelly}, 549 P.2d 1240 (Cal. 1976) and in \textit{People v. Leathy}, 882 P.2d 321 (Cal. 1994). Supporting statement of those who demand that the Frye standard has survived the Federal Rules of Evidence was based on the thinking that the Federal Rules of Evidence when enacted was not intended to be a comprehensive codification and a number of other important evidentiary rules were provided only in a general fashion. Hence it was argued that as an established Rule and no statement repudiating Frye appears in the legislative history, the general acceptance standard remains intact. See, Paul C. Giannelli, supra n.95, at 1229.

\textsuperscript{176} For example, Frye standard was excluded in \textit{United States v. Williams}, 583 F.2d 1194 (2nd Cir. 1978). For more details see Paul C. Giannelli, \textit{ibid.} at 1229.
In United States v. Williams, the second Circuit Court questioned the Frye's general acceptance standard. In this case the admissibility of spectrographic analysis (voice print evidence) was the issue before the court. After considering the Frye standard, court admitted the spectrographic evidence even though it does not meet the Frye's general acceptance standard. Court found that it was very difficult to apply Frye's general acceptance standard. It did not explicitly reject the Frye standard, but created a new approach for the admissibility of scientific evidence. As a result, court opted reliability as a criterion in evaluating scientific evidence like any other evidence. Thus court cancelled the special status given to the scientific evidence distinct from other type of evidence. Court said, like any other evidence, scientific evidence shall be evaluated by weighing the probativeness, materiality and reliability against any tendency to mislead or confuse the jury or to prejudice the defendant unfairly. Williams's decision became a major breakthrough in the United States jurisdiction regarding the admissibility of scientific evidence. The significance of this case was that it required the judges, rather than scientists, to decide whether the evidence was admissible.

177 Ibid.
178 Ibid. at 1197-1201.
179 Ibid. at 1198.
180 Ibid.
181 Depending on this decision several commentators later incorporated in their work the reliability criterion. For example, Jack Weinstein and Margaret Berger, in their Evidence, listed the following factors for determining the reliability. They are as follows:

(1) The techniques of general acceptance in the field; (2) the experts identification and stature; (3) the use which has been made of the new technique; (4) the potential error rate; (5) the existence of specialised literature; (6) the novelty of the new invention; and (7) the extent to which the technique relies on the subjective interpretation of the expert. See, Jack Weinstein and Margaret Berger, Weinstein's Evidence (1995), p. 702.

182 Thus the role of scientists in evaluating the reliability of a novel scientific technique has transferred to the judges. But it creates doubt in the judicial community, how far
After six years Justice Becker, adopted a new approach in the leading decision, *United States v. Downing*, in which the court concluded that general acceptance should be rejected as an independent controlling standard of admissibility. The main issue in this case was, whether Rule 702 of the Federal Rules of Evidence permits a defendant in a criminal prosecution to adduce an expert testimony in the field of human perception and memory testimony concerning the reliability of eyewitness identification. After the analysis of Frye test, court said, the test suffers from serious flaws, and held a particular degree of acceptance of a scientific technique within the scientific community is neither a necessary nor a sufficient condition for admissibility; it is however one factor that a district court normally should consider in deciding whether to admit evidence based upon the technique. Court said the reliability standard as used by the courts is more flexible than the scientific "nose-counting" method as suggested in Frye.

Court then said, if scientific expertise has no established "track record" in litigation, the court might look for other factors that may bear on the reliability of evidence. The court identified them as:

(1) the novelty of the new technique, that is, its relationship to more established modes of scientific analysis;

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they can play this role without a thorough scientific background. See, the dissenting statement of Chief Justice Rehnquist, in *Daubert v. Merrell Dow*, supra n.34, at 487. He said "I defer to no one in my confidence in federal judges; I am at a loss to know what is meant when it is said that the scientific status of a theory depends on its "falsifiability", and I suspect some of them will be too".

183 753 F.2d 1224 (3rd Cir. 1985)
184 Ibid. at 1237.
185 Ibid.
186 Ibid. at 1238.
2) the existence of a specialised literature dealing with the technique;

3) the frequency with which a technique leads to erroneous results;

4) the type of error generated by a technique;

5) the district court may take judicial notice of expert testimony that has been offered in earlier cases to support or dispute the merits of a particular scientific procedure.\textsuperscript{187}

Thus in this case court adopted a more flexible approach to the admissibility of novel scientific evidence. The most significant pronouncement made by the court in this case was that, the trial court must balance its assessment of the reliability of a novel scientific technique against the danger that the evidence may confuse or mislead the jury.\textsuperscript{188} However, court refused to give a mandatory procedure that district courts must follow in every case involving scientific evidence. Instead, court formulated certain factors, which

\textsuperscript{187} Court claimed that the reliability standard is very flexible than the standard as provided in \textit{Frye}. Court identified that the reliability standard unlike \textit{Frye} standard does not require explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community. Court said that the "helpfulness" standard as provided in Rule 702 necessarily implies a quantum of reliability beyond that required to meet a standard of bare logical relevance. Court found that some scientific evidence could assist the trier of fact as provided in Rule 702 in reaching an accurate determination of facts in issue even though the underlying principles of that technique could not be made admissible under the strict "generally accepted" standard as provided in \textit{Frye}. In such circumstances court was of opinion that the trial court should admit the evidence excluding the \textit{Frye} standard. By saying this, court thought that it could justify its act by invoking Rule 702 of the Federal Rules of Evidence.

\textsuperscript{188} \textit{Ibid.} at 1238. This case shows that in United States by the enactment of the Federal Rules of Evidence, courts were eager to adopt a liberal standard for the admissibility of scientific evidence different form \textit{Frye}'s general acceptance test. The general trend was to give more discretion to the trial judges regarding the issue of admissibility. Court gave more importance to the factual situation of a case in hand than the reliability of particular evidence in consequence with the \textit{Frye} rule. Court's view was that a particular piece of scientific evidence can be held admissible if it is relevant to the facts in issue even though its reliability is not accepted by scientific community as stated by \textit{Frye} court.
could be included in the procedure for determining the reliability of scientific
evidence.\textsuperscript{189}

Thus the \textit{Downing} court explicitly adopted a test that focused on an
expert's reasoning, by saying that the trial court must identify the preferred
connection between the technical data and the disputed factual issues in a case.

In a 1989 decision, \textit{State v. Castro},\textsuperscript{190} the New York Court of Appeal formulated
an additional standard for the determination of novel scientific evidence. In this case
court reserved the \textit{Frye}’s general acceptance test for the scientific evidence when it
comes for the first time in a court of law seeking admission. The reasoning of the
\textit{Castro} court shows that once a scientific evidence got its permission to enter into
the legal faculty, in later cases court must check the evidence based on that
particular scientific technique, considering the performance made by an expert in
the particular case. For that, court suggested the trial court must conduct a
pretrial hearing by evaluating the experiments and calculations performed by an
expert in the particular case.\textsuperscript{191}

The cases discussed above resolve the dispute regarding the evaluation of
scientific evidence to some extent. However, since 1980’s the explosion of toxic
tort litigations in the United States jurisdiction, has paved the way for a new

\textsuperscript{189} \textit{Ibid.}

\textsuperscript{190} 545 N.Y. S. 2d 985 (N.Y. 1989).

\textsuperscript{191} \textit{Ibid.} at 999. Court opined that the pre-trial hearing would also serve to aid the trial
judge in formulating appropriate instructions to the jury in the event; sharp issues of
fact emerge from the hearing. Some pre-trial procedures were suggested by court.
They are (1) Notice of intent to offer an evidence should be served as soon as
practicable; (2) The proponent whether defence or prosecution must give discovery
to the adversaries statement and copies of data's and reports; (3) The proponent
shall have the burden of going forward to establish that the test and calculations
were properly conducted. Once this burden is met, the ultimate burden of proof
shifts by the adversary to prove, by preponderance of the evidence, that the tests
and calculations should be suppressed or modified. (at p.999).
debate regarding the utility of the standard provided by *Frye*, relevancy approach, reliability approach and other similar judicial approaches for screening novel scientific evidence. Owing to this litigation explosion on toxic torts, courts in United States were faced with a new evidentiary challenge based on causation theories. The speciality of causation theory is that, it is formed by a scientist independently for particular toxic tort litigation and may almost rejected by the general scientific community. Pointing out this reason, the U.S. courts regularly rejected the evidence adduced by the experts regarding causation because experts did not base their opinions on information reasonably relied upon by other expert's in the scientific community and their testimony does not meet minimum standards of reliability as provided in Rule 703 and 403 of the Federal Rules of Evidence. This attitude creates difficulty to the plaintiffs in toxic-tort litigations.

Meanwhile, the *Allied-Signal Corporations*¹⁹² case became a leading precedent in favour of intensive judicial scrutiny of scientific-evidence in toxic-tort litigations. In this case the issue before the Court of Appeal was whether trial court erred in excluding an expert’s testimony establishing a medical causation of toxic tort. The facts of the case reveal that plaintiffs husband Christophersen died as a result of a cancer formed in his colon (large intestine) and metastasised to his liver. Plaintiff contended that the cancer was caused by his regular visits of the area of the defendant’s plant in which batteries were manufactured. Christophersen was allegedly exposed to fumes containing nickel and cadmium released from the manufacturing process of nickel and cadmium batteries. In order to support this contention, a single medical expert testified for the plaintiff that this regular

exposure to these heavy metals caused the cancer that resulted in his death. The testimony was rejected by the district court on the ground that the basis of the expert's opinion was insufficiently reliable and in the alternative, was more prejudicial than probative. Hence the plaintiff preferred the appeal.

In appeal, the appellate court initially ruled that a trial court's ruling regarding the admissibility of expert testimony will be protected by an ambit of discretion and must be sustained unless manifestly erroneous. After this pronouncement, court went on to scrutinise the criterion regarding the admissibility of scientific evidence, relying on Rules 403, 702 and 703 of the Federal Rules of Evidence and the Frye Rule. The test focused on:

1. Whether the witness is qualified to express an opinion, as mandated by Rule 702 of the Federal Rules of Evidence? While considering this factor court said the Advisory Committee's note accompanying Rule 702 reads the broad language of the rule to permit expert testimony not only by experts carrying formal credentials such as university degrees and professional memberships but also by so-called skilled witnesses, whose experiences permit them to testify with authority on a given topic. While dealing with this factor court warned the trial judges that the qualifications of an expert should not be a substitute for scrutinizing an experts reasoning or methodology.\(^{193}\)

2. Whether the facts upon which the expert relies are the same types as are relied upon by other expert's in the field.\(^{194}\) An exemption is given to the common sense skepticism, if an expert's factual basis is derived.

\(^{193}\) *Ibid.* at 1110.

\(^{194}\) *Ibid.* at 1110.
not form treatment or observation, but from the subjective information obtained from counsel or client in preparation for trial.

3. The third factor is the Frye test. This factor stipulates that whether an expert in reaching his conclusion used a well-founded methodology or mode of reasoning, one “sufficiently established to have gained general acceptance in the particular field in which it belongs.” As long as the expert’s methodology is well founded, the nature of expert’s conclusion is generally irrelevant, even if it is controversial or unique. Citing Osburn v. Anchor Laboratories Inc., court said an expert’s opinion need not be generally accepted in the scientific community before it can be sufficiently reliable and probative in support of a jury finding.

4. Whether under Rule 403, the testimony’s potential for unfair prejudice substantially outweighs its probative value. Thus relevant evidence can be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

Applying the factors as formulated, court held, trial court did not err in excluding expert testimony. The reason given by the court in excluding the expert’s testimony was that the expert did not follow the methodology from which he had developed his theory of causation.

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196 825 F.2d 908 (5th Cir. 1987).
197 Applying Frye’s “general acceptance test” court said, only an expert’s “methodology” and “reasoning” will come under the test and not an expert’s “opinion”. An expert’s opinion need not be generally accepted in the scientific community before it could be sufficiently reliable and probative in support of a jury.
Here it is submitted that the view of the learned judge in the Allied Signal Corporations case will not give any relief to the toxic tort litigator's because the liberalised approach given by him in admitting the conclusion of a scientific expert's evidence will not give a good result as he intended. Conclusion or opinion is the final result given by an expert after applying a particular methodology or theory in a case in hand. The conclusion cannot be separated from methodology or theory. For a good conclusion there must be a good theory and technique and bad theory and technique always results in bad conclusion. Therefore, applying strict rule of "general acceptance" on a theory or methodology is in effect its application on a conclusion.

Thus after Frye's general acceptance test, certain new standards like relevancy and reliability came into existence in U.S. jurisdictions. These approaches got more strength by the enactment of the Federal Rules of Evidence. But the great problem faced by the court in this period was that there was no uniform standard for admitting scientific evidence. As a remedy to this problem the United States Supreme Court announced its significant pronouncement in 1993, known as the Daubert test. This test later became the holy scripture of the Circuit Courts and State Courts regulating the admissibility of scientific evidence. Hence it is pertinent to deal with that decision.

(v) **Daubert Test**

On June 28, 1993, Supreme Court of United Sates handed down the judgement in *Daubert v. Merrell Dow Pharmaceuticals Inc.* later came to be known as Daubert decision. Through this decision Supreme Court by its majority

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198 Daubert v. Merrell Dow Pharmaceuticals, Inc., supra n.34.
199 Ibid.
has settled the split among the Circuit Courts as to whether the Federal Rules of Evidence superseded the historical precedent of Frye’s general acceptance standard. While addressing the admissibility standard, the majority in *Daubert* placed a strong emphasis upon relevance and reliability as the centrality of the scientific method, for checking its admissibility. The court listed four factors as key criteria to guide the trial judges, when they are in the admissibility threshold. In short, the *Daubert* decision can be considered as a path breaker to the United States trial courts regarding the admissibility of scientific evidence.

**The Facts**

Facts of the case reveal that the petitioners, Jason Daubert and Eric Schuller, were minor children born with serious birth defects. They claimed through their parents that the birth defects were the result of an anti-nausea drug known as *Bendectin*, which was manufactured and marketed by the respondents company, Merrell Dow Pharmaceuticals Inc. They sued the respondent company in the California State Court.

The respondent then removed the suit to the Federal court on diversity grounds. When the case reached the Federal Court, the respondent moved for summary judgement, arguing that their drug *Bendectin* did not cause any birth defects in humans. To support this contention the respondent submitted an affidavit of a physician and epidemiologist, who had expertise in the field of causation in product liability risks from exposure to various chemical substances. Before giving affidavit, the doctor had examined more than 30 published studies

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200 Bendectin was prescribed to the petitioner’s mother as an antidote to morning sickness.

201 Ibid.
and literature on Bendectin and human birth defects, and concluded that no study indicated that Bendectin was capable of causing birth defects.

Against this contention, the petitioners responded by submitting the affidavits of eight other well-credentialed experts who concluded that the drug Bendectin could cause severe birth defects.\textsuperscript{202} Their conclusions were based on test tube and live animal studies. Moreover, they had made pharmacological studies of the drug and the re-analysis of other published epidemiological (human statistical) studies. Regarding this the respondent argued that the evidence was not admissible because the testimony of the petitioner’s experts contradicted the weight of scientific authority.\textsuperscript{203}

The court granted the respondent’s motion for summary judgement, stating that the scientific evidence was admissible only if the principle upon which it is based was “sufficiently established to have general acceptance” in the field.\textsuperscript{204} The court concluded that petitioner’s evidence did not meet this standard.\textsuperscript{205} The decision was later affirmed by the United States Court of Appeal for the Ninth Circuit. Hence the appeal was filed before the Supreme Court of United States for determining the question of law regarding the standard for admitting expert scientific testimony in a Federal trial. After hearing the petitioners, the Supreme Court granted certiorari to settle the sharp division among the Federal Circuit Courts regarding the proper standard for the admission of expert testimony.

\textsuperscript{202} \textit{Ibid.}

\textsuperscript{203} \textit{Ibid.}

\textsuperscript{204} \textit{Ibid.} at 477.

\textsuperscript{205} \textit{Ibid.} at 477. Given the epidemiological data available concerning Bendectin, the court held that the expert testimony not based on human studies was inadmissible. The court also held that the plaintiff’s experts opinions, based on recalculations of previously published data, were inadmissible partially because they had not been subjected to peer review.
The Majority Opinion

The majority judgement in this case was delivered by Justice Blackmun, joined with Justice White, O'Connor, Scalia, Kennedy, Souter and Thomas JJ. After a brief discussion of the Frye Case, Justice Blackmun acknowledged that the Frye test of admissibility had been superseded by the enactment of the Federal Rules of evidence. He noted, however, that although courts and commentators had debated the merits of Frye, the instant case was not concerned with its merits, but rather its continuing authority. Blackmun J. started his analysis with Rule 402 of the Federal Rules of Evidence. He started with this analysis because he had placed two criteria on the admissibility of expert evidence. They were the relevance and reliability of scientific evidence. The term relevance is defined in Rule 402 as evidence having a tendency to make the existence of any material fact more or less probable. This liberal statement led Justice Blackmun to interpret the Rules standard of relevance very liberally. Further he observed that neither the Rule 702 or the legislative history of the Rules explicitly mention the “general acceptance standard” as an “absolute pre-requisite” for the admissibility of an evidence. Considering these things court concluded that the Frye standard was inconsistent with the liberal thrust of the Rules.

Despite the liberal language used in Rule 702, court had also found that even though the clutches of Frye’s general acceptance standard had been relaxed, there are enough restraints provided in Rule 702 to limit the admissibility

\[206\] Ibid. at 479.
\[207\] Ibid. at 479.
\[208\] Ibid.
\[209\] Ibid. at 480.
\[210\] Ibid.
of purportedly scientific evidence.\textsuperscript{211} The court said that, under the Rules, the trial judge must ensure that any and all scientific evidence admitted is not only relevant but also reliable.\textsuperscript{212} Justice Blackmun stated that in the test of Rule 702, the word “Scientific” implied that testimony must be grounded in the methods and procedures of science, and the word ‘knowledge’ connotes more than subjective belief and unsupported speculation. He found that to be considered “scientific knowledge” an assertion must be derived from use of scientific method, and that the “proposed testimony must be supported by appropriate validation i.e., “good grounds, based on what is known”.\textsuperscript{213} In short what court held was an expert’s scientific testimony must establish a standard of evidentiary reliability.

Moreover, court found that the Rule further requires the evidence or testimony must “assist the trier of fact to understand the evidence or to determine a fact in issue”. This is an additional condition provided by the Rule, imposing a higher requirement of relevance.\textsuperscript{214} Thus court concluded that in order to admit evidence as scientific, it must be both relevant and reliable.

After considering the requirements of relevance and reliability, court proposed a special burden on trial judges. Interpreting Rule 104(a),\textsuperscript{215} court held, trial judge must determine at the outset, whether the expert was proposing

\textsuperscript{211} Ibid. at 480.
\textsuperscript{212} Ibid.
\textsuperscript{213} Ibid. at 481.
\textsuperscript{214} Ibid. at 481. Court by citing Weinstein and Berger, explained the term relevance. “Expert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful”. Weinstein and Berger, Evidence 702 (02), p. 702-18, as cited in Dauber.
\textsuperscript{215} Rule 104(a) Provides: “Preliminary questions concerning the qualification of a person to be a witness, the existence of a privilege, or the admissibility of evidence shall be determined by the court, subject to the provisions of subdivision (b) [Pertaining to conditional admissions]. In making its determination it is not bound by the rules of evidence except those with respect to privileges”. Rule 104(a) of the Federal Rules of Evidence, as quoted in Daubert at p.482
to testify (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. Thus through this case court gave a “gate keeping role” to the trial judges who are evaluating the reasons or methodology underlying the testimony to determine whether it was scientifically valid and whether that reasoning or methodology properly could be applied to the facts in issue. The court then offered certain factors to the trial judge, helping them in determining the relevance and reliability of scientific evidence. The factors can be summarized as follows:

1) Whether the theory or technique can be or has been tested;  
2) Whether the theory or technique has been subjected to peer review and publication; 
3) The known or potential error rate of a technique; 
4) Whether the theory or technique has received “general acceptance”

After formulating four factors, Daubert court pointed out that the inquiry envisioned by Rule 702 is a flexible one. Moreover, court has stated that the trial court while considering the admissibility of scientific evidence must keep in mind

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217 What court aims by publication is the submission of a new theory or technique to the scrutiny of the scientific community. Through this submission the substantive flaws in the methodology can be detected. The fact of publication (or lack there of) in a peer-review journal thus will be relevant, though not dispositive, consideration in assessing the scientific validity of a particular technique or methodology on which an opinion is premised.

218 This is an additional requirement to find out the flaws in an individual case involving scientific evidence.

219 Citing, United States v. Downing, 753 F.2d 1224 at 1238 (3rd Cir. 1985) court said, widespread acceptance could be an important factor in ruling particular evidence admissible, and a known technique that has been able to attract only minimal support within the community.
the Rules 703, 706 and 403. While detailing the guidelines, the majority was confident that federal judges possess the capacity to undertake the review.

The Minority Opinion

Chief Justice Rehnquist, joined with Justice Stevens concurred in part by saying that Frye standard did not survive the Federal Rules of Evidence. At the same time, they dissented in part because of the majority desire to make vague general observations regarding the construction of Rules. Chief Justice criticized the majority's decision in implementing an additional standard known as reliability, which he was unable to discover in Rule 402 of the Federal Rules of Evidence. He disagreed with the observation of the majority about the application of the guidelines. He has stated that it was doubtful whether the guidelines could be applied to non-scientific evidence and other technical or specialised knowledge. He was also doubtful in majority's confidence on Federal judges gate keeping role.

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220 Rule 703 provide that expert opinion based on otherwise hearsay is to be admitted only if the facts or data are of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject.

221 Rule 706 allows the court at its discretion to procure the assistance of an expert of its own choosing.

222 Rule 403 permits the exclusion of relevant evidence if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues or misleading the jury.

223 Supra n.34, at 482. However, it is not clear from the decision on what basis the judges were confident about the capacity of Federal judges in evaluating the scientific evidence. Their attempt in providing certain general guidelines makes clear that they had some doubts whether trial judges could successfully complete their job assigned.

224 Ibid. at 486.

225 Ibid.

226 Ibid. at 487.

227 Ibid. Chief Justice Rehnquist voiced the doubt in the following terms: 'I defer to no one in my confidence federal judges; but I am at a loss to know what is meant when
Analysis of the Decision

*Daubert* case reached the corridors of the United States Supreme Court when there was a gap between law and science. Lower courts in the United States were in dark regarding the implanting of scientific methods in legal scenes. *Daubert* decision provided an elaborate guidance to the lower courts for resolving the incongruity between law and science. Without any doubt one can say that *Daubert* decision is the blue print of law-Science relationship. Here it is significant to know, how *Daubert* decision becomes the saviour of courts in settling scientific issues. By entrusting trial judges the role of “gatekeepers”, what *Daubert* court intended was in creating a censor board for censuring bad or pseudo science from good science. Thus *Daubert* decision places a considerable burden on judges to evaluate scientific evidence prior to it being presented to a jury. *Daubert* Court insists that only legally reliable evidence shall enter into the admissibility threshold.

However, as Chief Justice Rehnquist has stated, it is doubtful how far trial judges can separate the wheat from the chaff. Scientific evidence comes from different areas. It is not possible for a human being in specialising all areas. It is said that the scientific status of a theory depends on its “falsifiability”, and I suspect some of them will be too I do not doubt that Rule 702 confides to the judge some gate keeping responsibility in deciding questions of the admissibility of proffered expert testimony. But I do not think it imposes on them either the obligation or the authority to become amateur scientists in order to perform that role.

The judicial responsibility of trial judges had increased by the *Daubert* decision than in *Frye*’s general acceptance standard. Under *Frye* this task was given to the scientific community. Thus *Daubert* court discarded the standard that was deferential to external groups with one that requires judges themselves to make the necessary determination. For more details see, David L. Faigman, Mapping The Labyrinth, Supra n.4

Evidence may come from traditional finger printing to DNA finger printing, Breath analyser to gas chromatography, from simple psychological syndrome evidence to highly confusing mental disorders. It is not possible for a judge to master in all these areas. *What Daubert* Court insists the trial judges is to appreciate these varying ranges of complex scientific evidence. This is a difficult task because all scientific
The only thing, which is possible, is to acquire some basic skills necessary to understand the scientific methods and to integrate scientific knowledge in their decision.\textsuperscript{230} Therefore, it is better for judges to become good judges than becoming good scientists in evaluating scientific claims. Judges must learn the methods of science not to resolve scientific debates, but rather to resolve legal debates.\textsuperscript{231}

determinations will consist of three levels of scientific analysis. The first step is the appreciation of the theory or principle of a scientific invention. This is the most difficult level for a non-scientist having no scientific background. In this level it is better to have deference to the scientific community for considering its general acceptance. In this level court can depend the scientific literature, publication, peer review etc., as provided by Daubert court. The second level is the evaluation of the general application of the theory. This is also a difficult process, because the application is a continuous process of its theory. Here court can use the tools provided by Daubert court in evaluating a technique. Next comes the case - specific application or conclusion derived by an expert in a particular case. In this stage the judge must analyse conclusion by balancing the probative value of evidence against the danger of unfair prejudice, confusion of issues, or misleading the jury, by invoking Rule 403 of the Federal Rules of Evidence. In this stage the technicality of the case-specific application of a particular technique must be evaluated by considering the factors like, (1) the credentials and experience of the technician performing the actual procedure used to produce the data; (2) the specifics of data collection for the data set presented; (3) the general reputation and track record of laboratory that produces the data; (4) the specifics of collection of any samples that were used to produce the data; (5) the extent to which the technique relies on the interpretation of an expert etc. For more details see, David L. Faigman, Elise Porter and Michael J. Saks, Supra n.46.

\textsuperscript{230} If it is not possible to evaluate the scientific evidence as provided, court can appoint their own experts or technical advisors as provided in Rule 706 of the Federal Rules of evidence. By Rule 706, court can appoint an expert witness on its own motion or on the motion of any party in dispute. The witness is also subject to cross-examination by each party, including a party calling the witness. See, Rule 706 of the Federal Rules of Evidence.

\textsuperscript{231} The Daubert majority itself has recognised the difference in finding of truth in laboratory and courtroom. Regarding this the majority observed as follows:

Yet there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly... We recognize that in practice, a gate-keeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes. (Daubert at p.485).
In *Daubert*, court did not specifically state about who is the final determinate of the validity of novel scientific evidence.\(^{232}\) It is also not clear from the wordings of the relevant Rules of the Federal Rules of Evidence that who is the final determinate of the validity of the novel scientific evidence.\(^{233}\) Normally the issue of admissibility will initially come before the trial judge, who can use his full discretion either to admit or reject the evidence. An appellate court will interfere only if there is any abuse in using that discretion.\(^{234}\) Once an apex court has finally settled it then the trial court must follow the precedent established on the issue. The reasoning behind this statement is that the validity of a scientific knowledge does not change from time to time and from court to court. Once the scientific community has finally accepted it, the theory and general application of scientific technique can be used uniformly throughout the jurisdiction. For example, a theory that DNA determines the physical characteristics of all living things and that every individual's DNA except identical twins are unique is a scientific truth, which has been accepted by the scientific community all over the world. If the apex court has once judicially noticed this scientific theory and its application then there is no need for the trial courts to evaluate that theory and its general application in subsequent cases. The only thing that the trial judges

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\(^{232}\) See, *Daubert decision*, supra n.34.

\(^{233}\) Rule 702 of the Federal Rules of Evidence only says that if scientific, technical or other specialised knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, expert evidence can be received.

\(^{234}\) In United States, it is settled that the trial court has wide discretion to admit and exclude expert evidence, which can be reviewed by the appellate court only if there is any serious abuse of discretion or prejudice to the parties. Thus regarding this recently in *Kumho Tyre Company, Ltd. v. Carmichael*, 143 L.Ed. 2d 238, Supreme Court of the United States has stated that, "a court of appeals is to apply an abuse of discretion standard when it "reviews a trial courts decision to admit or exclude expert testimony"... That standard applies as much to the trial courts decision about how discretionary authority is needed both to avoid unnecessary "reliability" proceedings in ordinary cases where the reliability of an expert's methods is properly taken for granted, and to require appropriate proceedings in the less usual or more complex cases where cause for questioning the experts reliability arises. (at p. 253).
must vigilant is about the case-specific application of the said scientific technique. Here lies the importance of the Daubert decision. Daubert court has given a clear guideline to the trial judges regarding the case specific admissibility of scientific evidence.235

Thus Daubert court has established some valuable guidelines for the evaluation of scientific evidence. It was in Daubert, that United States Supreme Court for the first time interpreted the text of the Federal Rules for the admission of scientific expert testimony. The court has also rejected the let-it-all-in relevancy approach and affirmed that trial court judges have a prominent role as "gate keepers" in excluding unreliable junk scientific evidence.

(vi) Criticism of Daubert Test

Though, Daubert has viewed as the first step in the development of a principled and determinate jurisprudence governing the role of science in the courtroom; commentators and courts opined that there are some major pitfalls in the Daubert standard of admissibility.236 One of the drawbacks pointed out against Daubert decision was that it omits to state the standard of review of trial judge's decisions made in pursuant to Daubert's new flexible inquiry.237 When the Frye standard was in existence, appellate courts could review the

235 Daubert majority has stated that the conventional devices like vigorous cross-examination, presentation of contrary evidence and careful instruction on the burden of proof are appropriate safeguards against absurd and irrational pseudoscientific assertions. Daubert's another factor, the potential error rate of a scientific device is also useful for trial judge in determining the reliability of scientific evidence. See, Daubert, supra n.34 at 484 - 85.


237 See, Daubert decision, supra n.34.
admissibility determination of the trial courts de novo. That means they can consider the entire trial procedure and determine the evidential validity of particular scientific evidence in issue. But, after the Daubert guidelines, appellate courts can review a trial court’s decision only for an abuse of discretion. Daubert court ought to have provided clearly about the standard of review of the trial court’s decision regarding the admission or exclusion of scientific expert evidence. The same issue came before the United States Supreme Court after three years in General Electric Co. v. Joiner. In this case the main issue before the Supreme Court was: “What is the standard of appellate review for trial court decisions excluding expert testimony under Daubert?”

The main question that arose before the court was whether a single non-stringent standard of abuse of discretion governs the appellate review of all decisions.

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238 Daubert court does not state that an appellate court only for the abuse of discretion can review the trial courts decision. Instead court requires the trial judges to make credibility decisions by balancing the probative value of preferred evidence against the danger of unfair prejudice, confusion or delay. See Daubert, at 484.

239 If decisions are reviewed with this deference, commentators opined that it would result in inconsistent decisions concerning the admissibility of novel scientific testimony and may go unchecked from jurisdiction to jurisdiction and from judge to judge. This inconsistency may cause the admissibility of more junk science.

240 118 S. Ct. 512 (1997). The facts of this case show that the plaintiff, Joiner’s lung cancer was caused from the employment of the defendants General Electric Company where he was employed for twenty years. He contended that the onset of his cancer was accelerated by his exposure to PCBs in the defendants company. The defendant moved for summary judgement contending that the plaintiff could not show that PCBs caused or accelerated the onset of lung cancer. The plaintiff defended the summary judgement by producing the affidavits of two scientists who had good experience in this field. After studying the matter, they opined that PCBs would generally promote lung cancer and concluded that the cause of Joiner’s cancer might also be PCBs. Rejecting this contention, district court granted summary judgement to the defendant. District court ruled that, the plaintiff’s causation theory that the PCBs promote lung cancer couldn’t pass the Daubert’s reliability test of admissibility. This finding was later reversed by the Circuit Court (11th Circuit) on the ground that there was abuse of discretion by the District Court in determining the standard of admissibility of the plaintiff’s expert evidence. Circuit court ruled as follows: “Because the Federal Rules of Evidence governing expert testimony display a preference for admissibility, we apply a particularly stringent standard of review to the trial judge’s exclusion of expert testimony.” Hence, the defendant preferred appeal before the Supreme Court.
rulings on the admissibility of scientific evidence. Reversing the standard applied by the Circuit Court, the Supreme Court ruled:

The question of admissibility of expert testimony... is revisable under the abuse of discretion standard. 241

Supreme Court held that “abuse of discretion” is the appropriate standard for controlling expert evidence. 242

Actually, in Daubert what court attempted was to rectify the mistakes of the Frye decision. However, the court failed to resolve one important issue regarding the standard for admitting non-scientific evidence. 243 Even after the Daubert decision, the issue regarding the standards for admitting non-scientific evidence remains unsettled. 244 The Supreme Court in Kumho Tyre Co. v. Carmichael later considered this. 245

241 Ibid. at 517.

242 Instead of remanding the case to the lower court, Supreme Court held that the District Court in this case did not abuse its discretion when it excluded certain proffered expert testimony. Ibid. at 515.

243 Frye’s “general acceptance” standard has determined only the admissibility of scientific evidence. See, Frye v. United States, Supra n.69, at p.1014.

244 The majority in Daubert decision has stated that they are limiting their discussion to the scientific context because the issue in this case was regarding the scientific expert testimony of an antinausea drug known as Bendectin. See Daubert, supra n.34, at 481. The interpretation given by the Daubert court to the word “scientific” as provided in the Rule 702 of the Federal Rules of Evidence was very narrow. The court stated that the word “scientific” implies grounding in the methods and procedures of science. Thus the word “Scientific” as used in Rule 702 appears only to refer pure and hard science. That means scientific knowledge created through observation and experimentation. Moreover, court states that the evidentiary reliability will be based on scientific validity. But commentators rightly opined that this is not a correct view. Paul S. Milich, in his article states as follows:

... the scientific method” is not the same for all disciplines of science and in any case does not specify a particular level of “appropriate validation” before a principle or methodology is accepted as reliable. There are many different degree of scientific reliability and whether something is “reliable enough” depends upon the use to which one wants to put it and the risk of error one is willing to accept under those circumstances.
In this case Supreme Court answered three important questions. First, court held that the trial court’s "gate keeping role" as provided in Daubert applies to all expert testimony, either scientific or non-scientific.\(^{246}\) Secondly, it held, trial courts have great discretion in determining whether to apply the Daubert factors or to take other indicia for the case in hand.\(^{247}\) Thirdly, court opined that the trial court must have broad discretion to determine what proceedings are necessary to evaluate an expert’s reliability in a particular case.\(^{248}\)

The facts of the case were that the plaintiffs were travelling in a mini van driven by one of them. While, the right rear tyre of the van blew out and one of the passengers died, and others were severely injured. The driver of the vehicle brought a suit against the tyre maker and distributor, Kumho Tyre Company, claiming that the tyre was defective.\(^{249}\) In support of their contention they sought the assistance of a mechanical engineer (Carlson) who studied the issue and

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He has given an example in the note stating that designers of nuclear power plants presumably seek extremely high levels of reliability in the principles and methods upon which they rely while a psychiatrist treating a patient on the other hand may require less in the way of proof and reliability, before using certain new principles or techniques. See, Paul S. Milich, "Controversial Science, supra n.139, at 920.

There was a difference of opinion regarding the application of Daubert’s four factors to non-scientific testimony. Whatever the opinion may be, it is unnecessary to screen a non-scientific testimony under the Daubert four factors. In Daubert, court made these factors for determining the reliability of scientific testimony because they are more complex and beyond the analysis of common man. On the other hand, non-scientific testimonies were considered by courts as easy to evaluate because they believe the cost of erroneously admitting this type of testimony is low. They opined that the jury is better able to evaluate it because the information is more common to them. See, Ristina L. Needham, "Questioning The Admissibility of Non-Scientific Testimony After Daubert: The Need for Increased Judicial Gatekeeping to Ensure the Reliability of all Expert Testimony", Fordham Urban L. J. 541, at 561(1998).

\(^{245}\) 143 L.Ed. 2d 238 (1999).
\(^{246}\) Ibid. at 250.
\(^{247}\) Ibid. at 253.
\(^{248}\) Ibid. at 252-253.
\(^{249}\) Ibid. at 247.
concluded that a defect in the manufacture of the tyre caused the blow out.\textsuperscript{250} In the summary hearing, Kumho tyre asked the District Court to exclude Carlson’s testimony on the ground that his methodology failed Rule 702’s reliability requirement. The District Court, excluded Carlson’s testimony on the ground that it was inadmissible under the reliability requirement of Rule 702 and \textit{Daubert} factors.\textsuperscript{251}

Against the summary judgement, plaintiffs appealed to the 11th Circuit Court of Appeals. The Court of Appeal reversed the judgement of the District Court saying that, \textit{Daubert} does not create a special analysis for answering questions about the admissibility of all expert testimony. Instead, it provides a method for evaluating the reliability of witness who claims scientific expertise. Thus Court of Appeals limits the \textit{Daubert} factors to scientific expert evidence.\textsuperscript{252}

When case reached the Supreme Court, the court was faced with the dilemma of how to interpret and apply Rule 702 to non-scientific expert testimony. The court started the discussion about the impact of \textit{Daubert} decision in expert evidence and concluded that the criteria formulated in \textit{Daubert} could be

\textsuperscript{250} Carlson had a master degree from Georgia and experience in designing and testing truck tyres. He based his conclusion on the examination and report of a fellow employee, his visual inspections of the failed tyre. The defendant contended that Carlson had only visually inspected the tyre for the first time on the morning of his deposition. He had also noted that Carlson’s inspection had been undertaken in a lawyer’s office rather than in a laboratory.

\textsuperscript{251} District Court examined Carlson’s methodology in the light of the reliability related factors that \textit{Daubert} mentioned as testability, Peer review or publication, known or potential error rate and degree of acceptance in the scientific community, and found that all these factors were against the reliability of Carlson’s method. However, District Court agreed that \textit{Daubert} factors should be applied flexibly and other factors could argue in favour of admissibility. (\textit{Kumho} at p 249).

\textsuperscript{252} Circuit Court separated \textit{Daubert} standard of admissibility as scientific and non-scientific. Court concluded that Carlson’s testimony based on experience falls outside the scope of \textit{Daubert} criteria because \textit{Daubert} analysis applies only where an expert relies on the application of scientific principles rather than skill or experience-based on observation. See, \textit{Kumho} decision at p. 249.
applied in all expert testimony without any classification between scientific and non-scientific expert testimony.\textsuperscript{253} The court found that Rule 702 makes no distinction between scientific knowledge and technical or other specialised knowledge.\textsuperscript{254} The court also noted that scientific experts do not enjoy more exposure right in the courtroom than experts testifying about technical or specialised fields.

The Supreme Court has concluded that a trial court may consider one or more of the specific factors that \textit{Daubert} mentioned would help to determine the testimony's reliability. As regards the reasoning of District Court, the Supreme Court said the test of reliability is flexible and that \textit{Daubert}'s list of specific factors neither necessarily nor exclusively applies to all experts or in every case. The court opined that the trial court determination of the relevance and reliability of an expert's testimony would depend on the facts of the particular case. The court stressed that \textit{Daubert} factors though helpful are not a definite checklist or test to be considered in each and every case.

The court also cautioned that the general acceptance factor couldn't be used to allow unreliable disciplines to become the subject of expert testimony.\textsuperscript{255}

\textsuperscript{253} 143 L Ed. 2d 238 at 249-50.

\textsuperscript{254} Court reasoned that Rule 702 of the Federal Rules of Evidence makes no distinction between scientific knowledge and technical or other specialised knowledge. Citing \textit{Daubert} court argued that it is the Rule's word "knowledge" and not the words like "scientific" that modify the word that establishes a standard of evidentiary reliability, and came to the conclusion that as a matter of language, the Rule applies its reliability standard to all scientific, technical or other specialised matters and not exclusively to scientific knowledge. \textit{Ibid.} at 250.

\textsuperscript{255} 143 L Ed. 2d at 252.
Finally, court concluded that the Circuit Court committed error by restricting the
Daubert factors to scientific principles.256

The Supreme Court also extended the stand taken in Joiner257 to this
decision, saying that a trial court's decision regarding exclusion or admission of
expert testimony must be reviewed by the appellate court only if there is any
abuse of discretion.258

Thus through Kumho, Supreme Court diluted the factors provided by
Daubert by saying that full gatekeeper proceedings are unnecessary in ordinary
cases where the reliability of an expert's methods is properly taken for granted,
but are appropriate only where the reliability is called sufficiently into question.

(vii) Over-all View of the Decisions - From Frye to Daubert to Kumho

Frye's "general acceptance" standard was widely accepted by courts and
commentators. Frye test gave some help to the trial judges when there was no
standard for evaluating novel scientific evidence. The principal significance of the
Frye test was its pronouncement of a method for ensuring the "reliability" of
scientific evidence259. Frye court identified the difference in evaluating "Scientific
reliability" and "legal reliability". Therefore, court specifically stated that the

256 Regarding this, court specified that, "we do not believe that Rule 702 creates a
schematism that segregates expertise by type while mapping certain kinds of
questions to certain kinds of experts. Life and the legal cases that it generates are
too complex to warrant so definitive a match." Ibid. at 252.


258 The wording of Justice Scalia in his concurring judgement regarding the trial court's
discretion is valuable. He explained the term discretion in connection with the
evaluation of expert evidence as follows: "... The discretion it endorses—trial-court in
choosing the manner of testing expert reliability—is not discretion to abandon the gate
keeping function. I think it worth adding that it is not discretion to perform the function
inadequately. Rather, it is discretion to choose among reasonable means of
excluding, expertise that is fausse and science that is junky... The Daubert factors
are not holy writ, in a particular case the failure to apply one or another of them may
be unreasonable, and hence an abuse of discretion". Ibid. at 256-57.

259 See. Paul C. Giannelli, supra n.95, at 1207.
scientific community must accept every scientific invention or discovery. Philosophy underlying the ruling was that, Frye court recognises that in the matter of specialisation like science, the reliability must be assessed by practising scientists having scientific merits and not by non-scientists having no scientific foundation. Thus Frye court’s ruling insists the judges to have complete deference to scientists for determining the scientific merit of proffered evidence and thereby assures that the ball is in the right court. Deference to the scientific community will give uniformity in decision-making and eliminates the consumption of time due to the full-fledged hearing of a novel technique. Thus two pages Frye decision became the philosophical core for evaluating scientific expert testimony. However, United States courts were late to discover the philosophical insight of Frye standard. The main reason was that the Frye was only a Circuit Court decision and the majority of the U.S Supreme Court did not cite it at least once before 1993. But by the end of 1990’s the Frye test became the majority test for the admissibility of novel scientific evidence. At the same time it was seriously criticised by some courts and commentators, for its conservative approach and the difficulty in finding the relevant scientific community.260

The problems created and unaddressed by ‘Frye’ were rectified by enacting the Federal Rules of Evidence in 1975. Rules provide a liberal attitude toward the admission of expert evidence.261 But the Rules omitted to say whether the 50 years old Frye test was superseded by Federal Rules of Evidence or not. This resulted in confusion among courts, whether or to what

260 Courts differed on the issue of who constitutes the relevant scientific community for acceptance, as well as what precisely that community must have approved in a given case. See, Bert Black, “A Unified Theory, supra n.42 at 627-28; McCormick’s Handbook on The Law of Evidence (2nd ed. 1972), p.491.

extent the Frye's general acceptance standard was to be followed. Since, the common practice was that, some courts continued to give great deference to expert testimony based on Frye's test and some others rejected the general acceptance rule and vigorously scrutinised expert testimony.

Thus a split arose between the Federal Courts regarding the standard for the admissibility of scientific evidence. Some Circuit Courts formulated their own standard of admissibility rejecting Frye's general acceptance test. This results in the formation of new standards like reliability test, Kelly-Frye test, reasoning test etc. These different standards make admissibility more confusing and lacking uniformity in application.

The confusion was finally resolved in Daubert v. Merrell Dow Pharmaceuticals. Supreme Court of United States has stated that Federal Rules of Evidence superseded Frye's general acceptance standard. The court then formulated a new standard relying on relevant provisions of the Federal Rules of Evidence. Different from Frye, Daubert court held that evidence must be classified as scientific and non-scientific and scientific evidence must be presented to jury only if a judge determines that it consists of inferences and assertions derived from a valid scientific method. Thus Daubert court entrusted trial judges a gate keeping function in evaluating scientific evidence. Many courts and commentators described Daubert as a major paradigm shift because its flexibility had replaced the 70-year-old Frye's conservative test. One of the major advantages of Daubert standard was its application. Daubert standard can be equally applied in both novel scientific evidence and scientific evidence, which

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263 Supra n.34.
had already got judicial recognition. Thus Daubert court removed the difficulties surrounding Frye's general acceptance standard. But at the same time Daubert test was seriously criticised by some one for its ambiguities. The main criticism was levelled against its application. In the Daubert case itself Chief Justice Rehnquist while delivering his dissenting judgement stated that Daubert's majority judgement was silent about whether the decision can be applied in non-scientific evidence. He concluded his judgement by saying that this might create future problems. It happened as stated by Chief Justice Rehnquist.

Later in 1999 Supreme Court of United States clarified the omission made in Daubert through Kumho Tyre Co. v. Carmichael. In this case court mandated that trial judge's duty to act as gatekeepers would apply to all forms of expert testimony. Thus through these decisions standards of admissibility of scientific expert opinion were almost settled by the United States Supreme Court.

(viii) Impact of 2000 Amendment on Rule 702

On December 1, 2000, Rule 702 of the Federal Rules of Evidence was amended to codify the decisions in Daubert and Kumho Tyre Co. Amended Rule requires a three-part reliability test in addition to the existing "helpfulness test" and "qualified witness test". They are (1) the testimony is based upon sufficient facts or data; (2) the testimony is the product of reliable principles and methods; (3) the witness has applied the principles and methods reliably to the facts of the case.

The first part of this test is a new requirement that neither Daubert nor Kumho Tyre expressly settled. This part clearly requires the expert to prove the facts and data on which his testimony is based. The second part is entirely...
based on the factors already identified by the Supreme Court in *Daubert* decision which includes the testability of the theory or technique, known or potential error rate of the technique, peer review and publication and general acceptance of the technique within the relevant scientific community. The third part exclusively deals with some specific factors while applying the technique on a particular occasion. They include, (1) whether the expert’s opinion was developed expressly for the purpose of testifying, or as a result of independent research; (2) whether the expert has unjustifiably extrapolated from an accepted premise to an unfounded conclusion; (3) whether the expert has adequately accounted for obvious alternative explanations; (4) whether the expert is being as careful as he would be in his regular professiona work out side his paid litigation consulting.

It is interesting to note that even after the amendment to Rule 702, courts in United States were eager to follow the guidelines issued by the *Daubert* court. At the same time some courts were reluctant in applying the *Daubert* factors as the sole criteria for evaluating the expert evidence. In *Tech. Licensing Corp. v. Gennum Corp.*, applying the amended Rule 702 of 2000 and *Daubert*, court held, in cases involving non-scientific testimony, district courts were not limited to the *Daubert* factors in assessing the reliability of the proffered expert testimony. The court said, the trial judges enjoy broad discretion in determining both how to assess reliability and whether it exists. But in this case court has made a

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265 *Anderson v. Boeing Co.*, 222 F.R.D. 521 (10th Cir. 2004) (Court said, Daubert articulated the standard for admitting expert scientific testimony in a federal trial); *Guerre-Chaley v. State*, 88 P.3d 539 (9th Cir. 2004) (if an expert witness purports to base an opinion on the results of a test that has not been shown to have scientific validity under Daubert, a trial judge can prevent the witness from offering that opinion. In such a situation, the proposed expert testimony would fail to meet the standards set forth in Federal Rules of Evidence 702).

266 2004 U.S. Dist. LEXIS 10604 (9th Cir. 2004).
contradictory opinion by citing Kumho Tire Company, Ltd. v. Carmichael. The court held Daubert’s “gatekeeping" obligation has subsequently been extended to cover all expert testimony, not just that characterized as scientific. The court has made an erroneous declaration by saying that in determining the reliability of expert testimony, the trial court is limited to consider the methodologies relied upon by the expert, rather than the conclusions reached by such expert.

It is submitted that the view taken by the court is absolutely erroneous because one cannot evaluate the methodology of an expert’s evidence excluding the conclusion reached by him using that methodology. The evaluation of the methodology of an expert’s evidence will not gain anything if its conclusion is not tested in the light of the methodology from which it has been reached.

(II) The Admissibility of Scientific Evidence in Canada

In Canada, like United States there is no particular standard for the admissibility of Scientific Evidence. Some courts were using “reliability” and “helpfulness” as standards. The Canadian courts were against the "general

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267 526 U.S. 137.

268 In their leading textbook on evidence law in Canada, Sopinka J. et al state, “English and Canadian courts have not attempted to create a single standard of admissibility for novel scientific evidence.” Sopinka et al, The Law of Evidence in Canada (Toronto: Butterworths, 1992), p.537. Similarly, in 1986 in the Ontario District Court, Kurisko J. wrote: “There is a dearth of authority or discussion of the rule.” R. v. Doe, (1986) 31 C.C.C. (3d) 353 at 362 (Ont. Dist. Ct.). Canadian courts were using their own standard for the case in hand and there is no uniform standard like “general acceptance” test as provided in U.S.A. or “helpfulness” test as provided in United Kingdom. Moreover, the test by which they are admitting scientific expert testimony is unclear and not identifiable. The real problem facing the courts in Canada is that they are in confusion regarding which standard to be used in screening scientific evidence. For more details about the recent problems faced by Canadian courts regarding admissibility of scientific evidence see, Paul Roberts, “Expert Evidence in Canadian Criminal Proceedings: More Lessons From North America” in Helen Reece, Supra n.39, at p.175. See also, Marie Lussier, “Tailoring the Rules of Admissibility: Genes and Canadian Criminal Law”, 71 Can. B. Rev. 319, at 337 (1992).
acceptance test" formulated in Frye. The Canadian Supreme Court got three chances to settle the issue but still it is not satisfactorily settled.

It was in 1987 the first Polygraph evidence similar to Frye came before the Supreme Court of Canada sought admission. R v. Beland was the decision in which majority of the Supreme Court ruled that polygraph evidence was inadmissible because the credibility of the issue it measures falls within the experience of judges and juries. The other reason given by the court in rejecting the evidence was that it would infringe the well-established rules of evidence. The facts of the case reveal that the appellant in this case along with some others were charged for a conspiracy to commit robbery. Later one of them became an accomplice in the case and came as the prosecution's principal witness. Believing the words of the accomplice, Crown said that the respondents were telling lie under Oath. Against this attack they sought permission to adduce lie detector test for proving their credibility.

However, the case cannot be considered as a case in which court seriously dealt with the standards regarding the admissibility of scientific


271 Ibid.

272 Ibid. at 418.
polygraph evidence. Majority in this case dealt only with the technicalities of evidentiary rules than the scientific validity of Polygraph evidence. Thus the Canadian Supreme Court wasted its first chance for prescribing the standard for the admissibility of scientific evidence. But the dissenting opinion of Wilson J., had gone ahead with the issue of determining the probative value of polygraph evidence. Judge said that it would be unjust to prevent the respondents from calling any evidence of probative value indicating that they were telling the truth. However, the stand taken by the majority in this case was correct because the main issue in this case was not regarding the standard of admissibility of scientific polygraph evidence, rather the relevance of polygraph evidence for testing the credibility of oath before the court.273

The Canadian Supreme Court in R v. Lavallee,274 considered the admissibility of expert psychiatric evidence concerning the behaviour of a woman who was sexually abused by her partner. The facts of the case were that the accused Lyn Lavallee killed her partner who had sexually abused her. At the time of trial she called a Psychologist to testify that the killing was due to a desperate act of a terrorised woman who had acted promptly in self-defence. Admitting the evidence of the Psychologist, trial court acquitted the accused. Prosecution applied before the Manitoba Court of Appeal for a retrial of the case on the ground that the trial court erred in admitting the testimony of the Psychologist


without giving adequate attention to the hearsay status of the facts on which the Psychologist had based his opinion. Justice Wilson, confirmed the acquittal stating the following reason:

Expert evidence on psychological effect of battering on wives and common law partners must, it seems to me, be both relevant and necessary in the context of the present case. How can the mental state of the appellant be appreciated without it? ... We need help to understand it and help is available from trained professionals.275

The significance of this case was that court admitted the scientific testimony of the psychologist without determining the scientific validity of the evidence.276 The prosecution throughout the case never challenged the scientific validity of the evidence. The Supreme Court ought to have considered the credentials of the scientific evidence before admitting it. By taking this liberal stand, Supreme Court once again wasted its opportunity in laying parameters for the admissibility of scientific evidence. However, Justice Sopinka in his concurrent judgement wrote a version in connection with Frye’s general acceptance standard.

In R v. Mohan,277 the respondent, a paediatrician was charged for the offence of sexual assault on his female patients. During trial the accused sought to call a psychiatrist to testify that the perpetrator of the offence alleged to have been committed would be one of a limited and unusual group of individuals, and

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276 The ruling in this case was considered by the commentators as bad because in almost all jurisdictions the evidence on battered women syndrome will be received only after a crucial scrutiny. For details see, D. Nicolson and R. Sanghvi, “Battered Women and Provocation: The implications of R v. Ahluvalia”, [1993] *Crim. L. R.* 728; D.L. Faigman, “The Battered Woman Syndrome and Self Defence: A Legal and Empirical Dissent”, 72 Va. L. Rev. 619 (1986).

that the accused did not fall within that group because he did not possess the characteristics belonging to that group.

For determining the admissibility of the evidence Sopinka J., formulated four criteria. They are (1) relevance (2) necessity in assisting the trier of fact (3) the absence of any exclusionary rule and (4) a properly qualified expert. In this four-part test the first two i.e., relevance and necessity in assisting the trier of fact were considered by the judge as primary for the admissibility issue.

After stating this test, Sopinka J., went on to state an additional requirement, which is similar to that of "general acceptance standard" in Frye. He explained that the trial judge should consider the opinion of the expert and decide whether the expert is merely expressing a personal opinion or whether the behavioural profile which the expert is putting forward is in common use as a reliable indicator of membership in a distinctive group. However, he did not cite any United States case law like Frye or Daubert. Thus Sopinka J., limited the admissibility criteria to the case in hand. After this case Canadian Courts got complete discretion in fixing their own standards for the admissibility of scientific evidence.²⁷⁸

The three decisions delivered by the Supreme Court of Canada makes clear that court is reluctant to fix a permanent standard for the admissibility of scientific evidence. Instead, what court appears to favour is to determine the admissibility issue on a case-by-case basis.

²⁷⁸ Recently in R. v. J. (L.J.), [2000] 2 S.C.R. 600, Supreme Court applying the Mohan standard observed: "The trial judge's discharge of his gatekeeper function with respect to the admissibility of expert evidence must be taken seriously. It requires consideration of the following Mohan criteria... The trial judge's discharge of his gatekeeper function deserves a high degree of respect... where no scientifically established standard profile has been developed, the "distinctive group" exception recognized in Mohan will likely not apply."
(III) English Position - Helpfulness as a Criterion for the Admissibility of Scientific Evidence

In England, to admit a particular piece of scientific expert evidence, it must be “helpful” to the trier of fact. If it is helpful then it is admissible, regardless of whether its theory or technique that forms the basis of the testimony is reliable or the relevant scientific community accepts it. The English Court of Appeals established the “helpfulness” standard for the first time in R v. Turner. Regarding this, Lawton L.J. said:

If on the proven facts a judge or jury can form their own conclusions without help, then the opinion of an expert is unnecessary. In such a case if it is given dressed up in scientific jargon it may make judgement more difficult.

Whether a particular piece of evidence is helpful or not will be determined by the trial judge according to his subjective satisfaction after considering the nature of evidence produced. Using this principle, Judges may exclude relevant evidence, if it is not helpful. Thus expert evidence on behavioural sciences including psychological syndromes arising from child sexual abuse syndrome,

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279 In England, the test like Frye in United States has no relevance. Recently in R v. Dallagher, [2003] 1 Cr. App. R.195, (court quoted a passage from Cross and Tapper and said, “The better, and now more widely accepted, view is that so long as the field is sufficiently well-established to pass the ordinary tests of relevance and reliability, then no enhanced test of admissibility should be applied, but the weight of the evidence should be established by the same adversarial forensic techniques applicable elsewhere”). Similarly in R v. Giffoye, [2001] 2 Cr. App. R. 57, (Rejecting the expert Psychologists opinion on whether the victims death was caused by suicide, court held, it was not necessary to receive such type of evidence in such situations in which ordinary people could form their inferences from the proved facts). In England, courts were reluctant to admit a piece of evidence, which is not helpful, to them to settle a fact in issue. Helpfulness means helpful to the judges in arriving a particular conclusion. Judges in England will not allow an expert to trespass into their preserve. They believe that the authority of the trier of fact is absolute, therefore, evidence deemed to intrude on that authority would be excluded. For details see, T. Hodgkinson, Expert Evidence Law And Practice (London, 1990), p.122.

280 (1975) 1Q.B. 834.

281 Ibid. at 841.
battered women's syndrome or rape trauma syndrome are regularly excluded on the belief that they are matters within their own knowledge.282

Except the common law rule that the scientific expert's testimony must be helpful to the trier of fact, courts in England have taken a liberal attitude in admitting scientific expert testimony. The position in England is that any scientific witness can testify on the subject of his expertise, if he is qualified for that.283 It is the absolute discretion of the trial judge in adopting the standard for admitting a particular piece of evidence. No uniform standard has been prescribed by the apex court for evaluating scientific evidence. Thus in R v. Robb,284 English Appellate court has taken a liberal stand in admitting the expert scientific testimony identifying the voice of the accused from the conversation recorded in a tape. In this case the expert himself has stated that the technique used by him was unreliable. However, court held the opinion admissible, stating that neither general acceptance nor

282 Recently in R v. Huckerby and another, [2004] All ER (D) 364, citing Turner [1975] Q.B. 834, 841, court held the expert Psychiatric evidence was not admissible for evaluating the witness testimony. Court observed:

In most of the cases to which we have been referred, the circumstances in which psychiatric evidence has been held admissible to assist the jury in the inferences to be drawn from the actions or reactions of the defendant have been confined to situations where the defence raised directly invokes the issue of the mental health of the defendant. However, this court has long recognised an exception in the case of 'out of court' confessions where there is evidence of a disorder of a type properly to be regarded as a mental illness or condition such as might render the defendant peculiarly vulnerable to pressure or suggestibility. Similarly, in the case of the defence of duress. The rationale justifying such a course has been articulated in terms which are not restricted to those circumstances, although usually accompanied by re-affirmation of the principle that juries are well able to assess, and should properly be left to assess without assistance the variety of conditions and characteristics encountered in human beings in ordinary life (at Para 103).

The tendency of English Courts in excluding behavioural science evidence was seriously criticised by many commentators in law and science. For example, see, R.D. Mackay and A.D. Colman, "Equivocal Rulings on Expert Psychological and Psychiatric Evidence: Turning a Muddle in to Nonsense", [1996] Crim. L. R. 88.


284 ibid
reliability is a criterion for admitting expert scientific testimony. The court said, a scientific expert's evidence is admissible, if he is qualified by academic training and practical experience and able to give testimony with a value significantly greater than that of the ordinary untutored layman.

After Robb, courts in England had changed their liberal attitude towards scientific evidence because the prosecution misused most of the later cases in which novel scientific evidence adduced.285 This results in serious thinking among commentators regarding the imposing of a stricter standard for the admission of scientific evidence.286

Recently, English courts took a liberal stand and said if there is any real expertise on any person which ordinary person with their common sense could not decide, it should be taken into consideration. Thus in R v. Luttrell and

285 For example, a leading criminal case, R v. Mcllkenney, [1992] 2 All ER 417, gathered public attention for its unreliable and misleading scientific evidence adduced by the prosecution. In this case the accused was convicted by the trial court for the bombing of two pubs. The government scientific experts testified before the court that the substance found in the hands of the accused was nitro-glycerine, which has been regularly used in such type of bombs. To identify the chemical as nitro-glycerine, the expert had relied on a test known as "Griess test" (which is helpful to detect the nitrate through a chemical colour change). The evidence was disputed at trial. The scientific witness in this case convinced the judge by stating that there was a ninety-nine percent probability that shows the presence of nitro-glycerine. The case was tried in 1975 and in 1990 when the case came before the appellate court for the review of evidence, court realised that the "Griess test" was unreliable because the same substance could also be found in some soaps and detergent. Appellate court reversed the conviction of the trial court; see also another similar case R v. Maguire [1992] 2 All ER 433, in which appellate court reversed the conviction of the trial court reying on prosecutions scientific experts evidence on nitro-glycerine.

others, court held, the novel expert evidence is admissible regardless whether it is scientific or not, if the evidence satisfies two conditions: first that the study or experience of a witness would give that witness's opinion an authority which a person without that study or experience would lack; and secondly, that the witness was qualified to express the opinion. The court opined that there is no need of any special evaluation like verifiability or falsifiability. Moreover, court said, a skill or expertise could be recognised and respected, and thus satisfy the conditions for admissible expert evidence, although the discipline is not susceptible to the sort of scientific discipline. However, court said, a special warning would be required in circumstances where experience, research and common sense indicated that there was a difficulty with a certain type of evidence.

In England, court expressly declined to endorse any particular standard for evaluating scientific evidence; the job was taken by the government. They have fixed no standard for admissibility but proposed to make certain reforms in the forensic science machinery. As a first step, the government of U.K. has authorised a Royal Commission (United Kingdom Royal Commission on Criminal Justice) to study and report regarding the shortcomings in forensic science system. The Commission made certain recommendations to the government. They can be summarised as follows:-

287 [2004] All ER (D) 454. In this case the defendants were charged with conspiracy to handle stolen goods and were convicted. Before the Court of Appeal, the main issue was relating to the admissibility of appropriate directions in respect of expert evidence of lip reading used at the trials.

288 Ibid. at Para 34.

289 Ibid. at Para 42.
1) The commission states that the forensic science department must provide certain procedures to upgrade the quality and performance of its employees.\textsuperscript{290}

2) The commission recommends the government to establish a new authority to investigate and report to the government regarding the performance, achievements and efficiency of forensic science laboratories.\textsuperscript{291}

3) The report provides certain basic qualifications for the person who is competent to be a forensic scientist. It states that the main qualification must be an academic degree in the relevant scientific discipline.\textsuperscript{292}

4) Commission recommends giving adequate facilities to the defence including the right to observe any further scientific tests conducted on a particular thing and to remove some of the material from the quantity collected by the prosecution to test the same.\textsuperscript{293}


\textsuperscript{291} Ibid

\textsuperscript{292} Ibid. at 150.

\textsuperscript{293} Ibid. at 155. Commission identified certain problems that had arisen in the forensic science service connected with defence in a criminal case. Commission has noted that almost all forensic science facilities were closely associated with State and there were only few scientists from whom defence can seek advice. To overcome this difficulty government gave executive agency status (authority to accept work from any one) to the two forensic science departments that had been attached to the police. But this did not benefit because the labs, which were under the control of Police, always created suspicion to the defence. Commission had also pointed out that when defence lawyers were in a position to conduct their investigations, crime scenes have often been disturbed, exhibits lost, damaged, or destroyed in testing, and the opportunity to examine victims or assailants might no longer be available. Evidence relevant to the defence case might not even be collected or noticed by prosecution authorities whose principal concern was to secure incriminating evidence. See, The report of the Royal Commission on Criminal Justice (1993), pp. 139, 140 and 155.
The recommendations made by the Royal Commission were not fully implemented by the government due to some financial problems. Government realised that the regulation of forensic science service through modifications as suggested by the Royal Commission would cost money.

(IV) Standard of Admissibility in Australia

In the list of countries, after United States, Australia will come in the second place for giving seriousness about the issue of admissibility of scientific evidence. Cases and commentaries in the Australian jurisdiction shows that the standard of admissibility in Australia had similarities with the United States standards. Some jurists opined that cases in United States directly influenced the decisions of Australian courts. But the Australian judges did not adopt the U.S. Standards as such; rather they have implemented an external assessment based on qualifications, experience and recognition of established fields.

Australian judges became vigilant in implementing standard for admitting scientific evidence starts with the controversial decision Chambertain v. R.

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296 153 C.L.R. 521(1984). Before this case, the Australian courts did not take any special standard for screening scientific evidence. For example, in Transport Publishing Co. v. Literature Board of Review, 99 C.L.R. 111 (1956), Australian High Court took a liberal approach and held that before admitting expert evidence, the party proffering the evidence must show that it is based on special study or knowledge of a qualified expert. This is only an external checking of opinion evidence. After four years, in 1960, Australian High Court through Justice Dixon has said, qualified experts evidence could be admitted if the substance of the testimony...
(known as the Dingo Baby Case). The facts of the case reveal that the accused, Alice Lynne Chamberlain was charged with the murder of her baby. The prosecution said that the accused cut her baby's throat in her family car and buried it in sand. The prosecution case rested on scientific evidence collected from the scene. This included the cuts on the baby's garments, bloodstains found on the baby's clothing and blood found in the defendant's car. In contrast, defence claimed that the death of the baby was caused by a dingo (wild dog). Accused claimed that she saw a dingo carrying her baby. But the prosecution neither found the dingo nor the baby, but the baby's clothes were found in a pile. Prosecution had stated that the accused cut the clothes of the baby to simulate damage by dingo, and removed the clothing and placed it in a pile. The trial court convicted the accused believing on the scientific evidence of the prosecution. The High Court of Australia also confirmed the conviction.

This decision was criticised by the scientific community in Australia expressing serious doubts about the prosecution's blood evidence.297 The Australian government ordered a Royal Commission to look into the misuse of forensic science by prosecution.298 The report speaks against the use of scientific evidence in Chamberlain case. After the Chamberlain decision, courts and commentators in

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Australia divided into two groups. One recommended a stricter test for the admissibility of scientific evidence and other argued for a liberal approach.299

The admissibility crisis in Australia was settled to some extent by the enactment of the Federal Evidence Code in 1995. Australian Parliament passed the Evidence Act, in 1995, in which Section 79 specifically deals with the admissibility of expert opinion. It provides as follows:

If a person has specialised knowledge based on the person's training, study or experience, the opinion rule does not apply to evidence of an opinion of that person that is wholly or substantially based on that knowledge.300

Thus Section 79 has provided a liberal approach to the admissibility of expert evidence in contrast to the public opinion in Australia. There is no requirement in Section 79 that the knowledge upon which expert opinion evidence is based must come under a recognised field of expertise. However,

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299 The major issue among the groups was whether America's Frye test could be applied as a standard for screening scientific evidence. The Law Reform Commission of Australia rejected Frye test and reliability test as standards. They recommended that scientific evidence may be excluded if it has any prejudicial effects, for its questionable reliability and its tendency to mislead, confuse or require undue time and cost. See, Australian Law Reform Commission, Interim Report No. 26, at p. 416 (1985). A prominent commentator in Australia, Ian Freckelton, has stated that the court room was not the proper forum to determine the reliability or validity of scientific technique, nor is it the right venue to assess whether controversy within the scientific community has subsided sufficiently for the technique or theory to be accounted as receiving general or even substantial acceptance within that community. See, Ian R. Freckelton, The Trial of The Expert (1987), p.172. In contrast, the Royal Commission favoured strict rules for the admissibility of scientific evidence. Some commentators argued that Australia's "organised branch of knowledge" and "field of expertise" tests are version of the Frye rule. For more details of the divided debate about admissibility standard see, Andrew L.C. Ligertwood, Australian Evidence (2nd ed. 1993), p.378, s. 7.40.

300 Section 79 of the Evidence Act, 1995. Some commentators opined that Section 79 of the Australian Evidence Act had close resemblance with Rule 702 and 703 of the Federal Rules of Evidence in United States. However, Section 79 of the Australian Evidence Act does not specifically provide "scientific knowledge", rather it states only "specialised knowledge". See, S. Odgers and J. Richardson, supra n.99, at 109.
Section 135 of the Act states that "the court may refuse to admit evidence if its probative value is substantially outweighed by the danger that the evidence might: (a) be unfairly prejudicial to a party or (b) be misleading or confusing; or (c) cause or result in undue waste of time." Commentators in Australia expect that due to a recent trend toward stricter scrutiny of scientific evidence, courts may try to interpret Section 79 creatively in order to avoid its liberal implications.

Recently in *HG v. R.*, High Court of Australia has said, the expression 'specialised knowledge' in the Evidence Act has been held to give rise to a test equivalent to the position at common law. Furthermore, court held, there must not only be a relationship between the opinion and the specialised knowledge; the strength of that relationship must reach such a level that it could be found.

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301 Section 135 of the Evidence Act '1995. This Section has a very close resemblance with Rule 403 of the Federal Rules of Evidence in United States.

302 See, Freckelton, "Expert Evidence and the Role of the Jury", 12 Austl. B. Rev. 73 at 87 (1994). In Australia, Commentators opined that courts would interpret Section 79 of the Australian Evidence Act in the same way American Supreme Court has done in *Daubert* decision. Odgers and Richardson, two prominent commentators in Australian jurisdiction has stated that the courts in Australia must adopt a standard for evaluating the novel scientific techniques in addition to the practical rules (dealing with expert opinion generally). They suggest that *Daubert* criteria in United States will provide an opportunity to clarify and improve the rules governing the admissibility of scientific evidence in Australian Legal system. They note that Sec. 79 of the Australian Evidence Act is different from Rule 702 of the Federal Rules of Evidence because Australian Provision does not specifically mention "scientific knowledge". Taking this difference, they pointed out that courts in Australia would provide a liberal attitude in admitting scientific evidence. Therefore they suggest reforming the Australian provision by amending Section 79 to include specific criteria for determining the admissibility of scientific evidence. See, S. Odgers and J. Richardson, supra n.99.


304 *Ibid.* at 432. Under the common law, the opinion of a supposed expert must lie within a field of knowledge which the law recognises as one on which expert evidence can be called. At common law, two principles govern the question of whether the field is one on which expert evidence can be called. The first seeks to exclude evidence on the ground that the ordinary person is as capable of forming a correct view on the question as anyone else. The second seeks to exclude evidence, which, since it is not based on an organised body of sound knowledge or experience, is insufficiently reliable. These two principles were summarised by King C.J. in *R v. Bonython*, (1984) 35 S.A.S.R. 45 at 46-7.
that the opinion is 'wholly or substantially based on the specialised knowledge. Regarding this Gleeson C.J. held:

An expert whose opinion is sought to be tendered should differentiate between the assumed facts upon which the opinion is based, and the opinion in question . . . the provisions of s 79 will often have the practical effect of emphasising the need for attention to requirements of form. By directing attention to whether an opinion is wholly or substantially based on specialised knowledge based on training, study or experience, the Section requires that the opinion is presented in a form which makes it possible to answer that question . . . [T]he witness had to identify the expertise he could bring to bear... in trials before judges alone, as well as in trials by jury, it is important that the opinions of expert witnesses be confined, in accordance with s 79, to opinions which are wholly or substantially based on their specialised knowledge. Experts who venture 'opinions', (sometimes merely their own inference of fact), outside their field of specialised knowledge may invest those opinions with a spurious appearance of authority, and legitimate process of fact-finding may be subverted.305

Later decisions in Australia shows that the Australian courts were eager to adopt a standard propounded by New South Wales court in Makita (Australia) Pvt. Ltd v. Sprowles306. The principles enumerated in this case were considered by the Australian courts as general principles for evaluating the expert evidence in Australia. The principles was explained by Heydon JA:

In short, if evidence tendered as expert opinion evidence is to be admissible, it must be agreed or demonstrated that there is a field of 'specialised knowledge'; there must be an identified aspect of that field in which the witness demonstrates that by reason of specified training, study or experience, the witness has become an expert; the opinion proffered must be 'wholly or substantially based on the witness's expert knowledge'; so far as the opinion is based on facts 'observed' by the expert, they must be identified and admissibly proved by the expert, and so far as the opinion is based on 'assumed' or 'accepted' facts, they must be identified and proved in some other way; it must be established that the facts on which the opinion is based form a proper foundation for it; and the opinion of an expert requires demonstration or examination of the scientific or other intellectual basis of the conclusions reached: that is, the expert's evidence must explain how the field of 'specialised knowledge' in which the witness is expert by reason of 'training, study or experience', and on which the opinion is 'wholly or substantially based', applies to the facts assumed or observed so as to produce the opinion propounded. If all these matters are not made explicit, it is not possible to be sure whether the opinion is based wholly or substantially on the expert's specialised knowledge. If the court cannot be sure of that, the evidence is strictly speaking not admissible, and, so far as it is admissible, of diminished weight. And an attempt to make the basis of the opinion explicit may reveal that it is not based on specialised expert knowledge, but, to use Gleeson CJ's characterisation of the evidence in *HG v. R* (1999) 197 CLR 414, on 'a combination of speculation, inference, personal and
second-hand views as to the credibility of the complainant, and a process of reasoning which went well beyond the field of expertise.  

(V) Position in India

Like developed countries, in India there is no duty entrusted to the trial judges either by the Supreme Court or law to screen the scientific evidence before entering the admissibility threshold. In India, the opinion of a witness possessing expert knowledge is admissible if the fact upon which the enquiry is to be made is such that ordinary persons cannot form a correct judgement with their common knowledge and skill. What Section 45 of the Indian evidence Act mandates is that he must be a person having special skill on the subjects provided. If he had, then his opinion is a relevant fact. Thus the relevance of an expert’s opinion is closely connected with competency. Therefore, courts were considering competency of the expert as a criterion for admissibility rather than reliability of the scientific theory or technique he used for arriving at a

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307 This was later followed in *Dean-Willicocks and Another v. Common Wealth Bank of Australia*, [2003] N.S.W.S.C. 466. (The opinions expressed in the reports were not wholly or substantially based on the specialised knowledge of the experts. The reasoning amounted to a series of inferences drawn from the text of documents and the circumstances disclosed therein. That type of analysis is the analysis undertaken by the court to resolve disputed questions of fact and as such purported to usurp the function of the court as the trier of facts: at 27, 32 and 40).

308 Supreme Court has not yet formulated a standard for screening scientific testimony.

309 Section 45 of the Indian Evidence Act provides as follows, “When the Court has to form an opinion upon a point of foreign law, or of science or art or as to identity of handwriting or finger impressions the opinions upon that point of persons specially skilled in such foreign law, science or art, or in questions as to identity of handwriting or finger impressions, are relevant facts. Such persons are called experts”. Thus in *Bal Krishna Das v. Radha Devi*, AIR 1989 All. 133, Allahabad High Court observed: “In view of language of Section 45, it is necessary that before a person can be characterised as an expert, there must be some material on the record to show that he is one who is skilled in that particular science. He must have devoted sufficient time and study to the subject to make his evidence trustworthy. However, the witness need not have acquired his knowledge professionally, it is sufficient if he has made a special study of the subject or has acquired special experience in it”; see also, *State of H.P. v. Jailal*, AIR 1999 S.C. 3318 at 3320-21.
particular conclusion. However, Section 51 of the Evidence Act provides, "whenever the opinion of any living person is relevant, the grounds on which such opinion is based are also relevant." But this is not a mandatory rule, which must be satisfied by the judges before admitting the evidence. The general practice is that the judges will receive the opinion of an expert after checking his competency in chief-examination, reserving the inquiry as to the grounds of opinion on cross-examination. While cross-examining the witness, if any suspicion arises regarding the grounds or reasons on which an opinion is based, court will inquire into the matter in detail for testing its reliability.

Section 293 of the Code of Criminal Procedure exempts certain government scientific experts from personal appearance before a court of law. The legislative intention behind this provision is to give some privilege to the higher officials in Forensic Scientific Departments. This privilege is given considering their qualifications, experience and work load in their field. But this privilege is not given to the scientists engaged in Private Laboratories. By invoking Section 293, court can admit any report under the hand of (a) any Chemical Examiner or

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310 It is the duty of an expert to prove his competency in chief-examination. Once it has been proved, his testimony becomes believable. It is the absolute discretion of the trial judge to decide the competency of a person in which his opinion is offered.

311 See, Section 51 of the Indian Evidence Act.

312 Testing competency is a preliminary examination conducted by the trial judge to check the qualifications of the expert. This does not make the opinion admissible, but only makes relevant under Section 45 of the Evidence Act. Admissibility is something more than relevancy. While dealing the admissibility issue, court will take into account the factors that may directly affect the strength of evidence. This may include the prejudicial effect of the evidence, the danger of error and the perfection of the opinion. In order to evaluate these things court may invoke Section 46 and 51 of the Evidence Act. By Section 46 court can receive evidence against the opinion under Section 45. Similarly Section 51 allows court to insist on the grounds or reasons in which an opinion is based. This may help the court to check the soundness of the opinion. However, Section 293 of Criminal Procedure Code allows the court to review the report of some persons (experts) without summoning or examining them. This is a special provision, which prevails over the general provision of Section 45 of the Evidence Act.

313 See, Section 293 of the Code of Criminal Procedure.
Assistant Chemical Examiner to government; (b) the Chief Inspector of Explosives; 
(c) the Director of Fingerprint Bureau; (d) the Director or Deputy Director or Assistant
Director of a Central Forensic Science Laboratory or a State Forensic Science
Laboratory; (e) the Director of Haffkeine Institute, Bombay and; (f) the Serologist to
the Government.\textsuperscript{314}

Thus through this Section a very wide discretion has been given to the trial
courts in admitting scientific evidence. The courts are expected to use this power
judicially without any abuse. Therefore, High Courts in India have given special
care to the cases in which the trial courts admitted expert evidence on reports.
Thus in \textit{Parwat v. Sukdev};\textsuperscript{315} Bombay High Court after pursuing the evidence of
the lower court, took the view that it was essential that the expert should have
stepped into the witness box and then perhaps for convenience he might have
been permitted to put his opinion on the record so as to enable the opponent to
cross examine him in reference to that opinion.\textsuperscript{316} The court further said, unless
the expert stepped into the witness box, the opinion expressed by him in a
communication to one of the parties could not be treated as evidence under the
Evidence Act.\textsuperscript{317}

\textsuperscript{314} \textit{Ibid.}
\textsuperscript{315} AIR 1956 Bom. 617. In this case the genuineness of a document was challenged
and the same was sent to a handwriting expert for examination. The expert
forwarded a report showing doubt on the genuineness of the document. But the
court did not examine the expert. The lower court has taken the view that though the
expert did not enter into the witness box and did not prove his opinion, a
communication received from him could be regarded as evidence.
\textsuperscript{316} \textit{Ibid.} at 618.
\textsuperscript{317} \textit{Ibid.} No such exemptions were given to doctors from appearing before a court. Court
has repeatedly stated that a certificate issued by a doctor must be proved by
examining him. Thus in \textit{Coral Indira Gounsalves v. Joseph Prabhakar Iswaraiah},
AIR 1953 Mad. 858, Madras High Court held that the certificates of doctors do not
prove themselves. The doctor who issues them must strictly prove them. He has to
state what tests he carried out to arrive at his conclusion and must stand cross-
examination and convince the court that his conclusion is correct. In this case a suit
However, this is not a hard and fast rule and in ordinary circumstances court may admit the reports as permitted by Section 293 of the Code of Criminal Procedure. Exceptional circumstances arise when there is any difference of opinion in the reports, or where the guilt or innocence of the accused turns entirely on the result of the report or if the report seems meagre or cryptic by which court cannot act, or absence of evidence connecting the incriminating articles seized, etc. Thus the question of summoning the expert is based entirely on the nature and circumstances of the case. Judicial practice shows that normally courts will insist that the report of a scientific expert must contain all relevant information required, including the reasons for arriving at a particular conclusion, the tests of experiments performed by him, the factual data revealed by such tests or experiments and the ultimate reasons which led him to form his conclusion, so as to enable the court to arrive at its own independent decision.

Thus, in State of Himachal Pradesh v. Jailal,\textsuperscript{318} Supreme Court established the specific proposition that scientific expert's opinion not supported by any reasons will not be relied upon. K.T. Thomas J., elaborated the courts stand when discussing the admissibility of the scientific evidence of a Horticulture officer:

An expert is not a witness of fact. His evidence is really of an advisory character. The duty of an expert witness is to furnish the judge with the necessary scientific criteria for testing the accuracy of the conclusions so as to enable the judge to form his independent judgement by the application of these criteria to the facts proved by the evidence of the case.

The scientific opinion evidence, if intelligible, convincing and tested was filed by the Plaintiff for declaring her marriage void on the ground of the impotency of her husband. He was examined by a doctor who gave a certificate that he is capable to the act of sexual intercourse, but the doctor was not examined.

\textsuperscript{318} AIR 1999 S.C. 3318.
becomes a factor and often an important factor for consideration along with the other evidence of the case. The credibility of such a witness depends on the reasons stated in support of his conclusions and the data and materials furnished which form the basis of his conclusions... the report submitted by an expert does not go in evidence automatically. He is to be examined as a witness in court and has to face cross-examination.\(^{319}\)

The above observation of the Supreme Court could be taken as a practice statement regarding the admissibility of scientific expert evidence in India. Court mandates that an expert for his conclusion should state the reasons and that he should be examined as an expert.

(i) **Corroboration - An Additional Requirement for Admitting Scientific Experts Evidence in India**

In India, the precedent generally following by the courts in the case of the admissibility of scientific evidence is that the courts may normally require "corroboration" as a rule of caution.\(^{320}\) Courts were reluctant to admit a particular piece of scientific evidence independently without a proper and supporting piece of other evidence.\(^{321}\) The term "corroboration" means a particular piece of evidence is supported or confirmed by other piece of evidence. This can be considered as an additional requirement for the approval of the scientific evidence in hand, despite of its weight to be given. If scientific evidence in a

\(^{319}\) *Ibid* at 3321.


case is supported or confirmed by another piece of evidence, one can say that
the latter one safely corroborates the former.322

In order to corroborate scientific evidence, the evidence used for the
corroboration must have some capacity to prove the fact in issue independently,
other than the scientific evidence in the case. The term independent
corroboration denotes that the evidence used for the corroboration must be free
from the influence of the scientific evidence.

The main reason for asking corroboration is that courts considered expert
evidence as a weak type of evidence to base a conviction. Therefore, in almost
all cases in which conviction has been based on expert evidence lacking other
independent evidence, Supreme Court has set aside the conviction. Thus in
Magan Bihari Lal v. State of Punjab323, Supreme Court set aside the conviction
confirmed by the Punjab and Haryana High court on the basis of the evidence
given by a handwriting expert. In this case the accused was charged for the
offence of forgery under Section 488, 411 and 428 of the Indian Penal Code. The
allegation against the appellant was that he used a forged railway receipt for
transferring the goods contained in the wagon of a goods train. In order to prove

322 The corroboration rule traces its historical underpinnings back to the development of
the corpus delicti rule, which is still followed in most jurisdictions. The term corpus
delicti means the 'body of the crime'. In United States they have formulated a
doctrine known as "trustworthiness" parallel to the corroboration rule. According to
this rule the corroboration required must have an effect to determine the
trustworthiness of the evidence in question. A mere independent evidence which
touches the corpus delicti of the crime is not enough to qualify it as a piece of
corroborative evidence. In a leading decision, Opper v. United States, 348 U.S. 84,
86 (1954), U.S. Supreme Court said that the trustworthiness rule has dual function in
the law of evidence. It tends to make the evidence in question reliable and also
establish independently the other necessary elements of the offence. For more
details about corpus delicti rule and corroboration rule see, Note, "Construed in Proof
of the Corpus Delicti Aliunde the Defendant's Confession", 103 U. Pa. L. Rev. 638
(1955); Major Russell L. Miller, "Wrestling with Mre 304(g): The Struggle to Apply the

323 AIR 1977 S.C. 1091
the handwriting in the forged railway receipt, the prosecution called handwriting expert. He testified that the handwriting in the forged receipt was of the same person (accused) who wrote the specimen handwriting. When the case came before the Supreme Court, court observed as follows:

It is well settled that expert opinion must always be received with great caution. ... There is a profusion of precedential authority which holds that it is unsafe to base a conviction solely on expert opinion without substantial corroboration. This rule has been universally acted upon and it has almost become a rule of law.

Thus in this case Supreme Court has opined that there is a universal rule of law that it is unsafe to base a conviction solely on expert opinion without substantial corroboration. However, there is a difference of opinion among courts regarding the insisting of substantial corroboration as a requirement for admitting scientific experts evidence.324

The basic principle of the law of evidence is that there is no rule regarding the number of witnesses necessary for proving a criminal charge. The testimony of a single witness or the availability of a single piece of evidence is enough for proving a criminal charge, if it had the quality to prove the fact in issue. Thus it is the quality of the evidence adduced and not the quantity of the evidence, which counts. Therefore, normally here a question may rise regarding the reasoning of the Indian courts in insisting a corroborative proof for admitting the evidence of

324 Compare, Murari Lal v. State of M.P., AIR 1980 S.C. 531 with State of Gujarat v. Abdul Rahim Abdullahabai Ranginwala, 1983 Cr. L. J. (NOC) H.P. In Murari Lal, Supreme Court said that there is neither rule of law nor any rule of prudence, which has crystallised into a rule of law that opinion evidence must never be acted upon unless it is substantially corroborated. On the other hand in Abdul Rahim’s case, Himachal Pradesh High Court has taken a different stand by saying that it is unsafe to base a conviction solely on expert opinion without substantial corroboration.
the scientific experts. The Supreme Court in Murlirial v. State of M.P \[^{325}\] clearly answered this question. In this case the main issue before the Supreme Court was regarding the legality of the conviction confirmed by the Madhya Pradesh High Court basing on the uncorroborated testimony of a handwriting experts opinion. The brief facts of the case reveal that the accused (appellant) was charged for committing murder. The police recovered from the crime scene a prescription pad, which had writing suspected to be in the handwriting of the accused. The police send this writing along with the specimen writings of the accused to the handwriting expert who opined that the same person made the both. This evidence indicated the presence of the accused in the house of the deceased, which indicted him to the charge under Section 302 of the Indian Penal Code. The trial court convicted the accused and the conviction was also confirmed by the High Court. Before the Supreme Court, the appellant's counsel argued that the handwriting experts evidence was wholly unacceptable, that it was not permissible in law to act upon the uncorroborated opinion evidence of the expert. Rejecting this argument, Supreme Court said that it is not reasonable to say that an expert's opinion cannot be used without substantial corroboration especially in courts. The court justified the reasoning as follows:

True, it has occasionally been said on very high authority that it would be hazardous to base a conviction solely on the opinion of a handwriting expert. But, the hazard in accepting the opinion of any expert, handwriting expert or any other kind of expert, is not because experts, in general, are

\[^{325}\] AIR 1980 S.C. 531.
unreliable witness- the equality of credibility or incredibility being one which an expert shares with all other witnesses.\textsuperscript{326}

Thus from this reasoning it is clear that the Supreme Court has considered all witnesses, either the expert witness or any other kind of witness in the same footing regarding credibility or incredibility of the things which they testify before the courts. Then what is the factor that differentiates them from other witnesses, which instigates the Indian courts in initiating corroborative proof for their evidence, is to be detected. In the light of the observation made by the court in Murarilal's case, it is submitted that it was the suspicion that arose in the mind of the judges regarding the reliability of scientific experts' evidence, which instigates judges for initiating further corroborative proof for scientific evidence. This suspicion will be strong in the case of conclusion of an expert derived from novel scientific evidence. Regarding this the court observed:

... all human judgment is fallible and an expert may go wrong because of some defect of observation, some error of premises or honest mistake of conclusion. The more developed and the more perfect a science, the less the chance of an incorrect opinion and the converse if the science is less developed and imperfect. The science of identification of fingerprints has attained near perfection and the risk of an incorrect opinion is particularly non-existent. On the other hand, the science of identification of handwriting is not nearly so perfect and the risk is, therefore, so higher.\textsuperscript{327}

However, court held that there is no rule of law or any rule of prudence, which has crystallised into a rule of law that the opinion of an expert must never

\textsuperscript{326} Ibid. at 534.
\textsuperscript{327} Ibid.
be acted upon unless it is substantially corroborated. In order to substantiate this
argument court referred Section 45, 114 and 3 of the Indian Evidence Act. After
referring Section 114 of the Evidence Act, court held that there is nothing in the
Evidence Act as provided in the illustration to Section 114\(^{328}\) of the same Act
which entitles the court to presume that an accomplice is unworthy of credit,
unless he is corroborated in material particulars, which justifies the court in
assuming that an expert's opinion is unworthy of credit unless corroborated.
What court found in Section 45 of the Evidence Act is that an expert testimony is
admissible, if it is based on the opinion of a person who is specially skilled for
that and not any thing more than that. This makes clear that in India the law is
silent regarding the standards to be adopted for evaluating an expert's evidence.
Actually this lacuna compelled the Indian Judges to insist corroborative proof as
a standard to check the scientific opinions given by the experts.

After referring various decisions delivered by the same court,\(^{329}\) court came
to the conclusion that after having regard to the imperfect nature of science, as a
rule of caution, court can insist corroboration in appropriate cases, but if the
reasons for the opinion are convincing and if there is no reliable evidence
throwing a doubt, the uncorroborated testimony of an expert may be admitted.\(^{330}\)

In *State of Maharastra v. Sukhdeo Singh*,\(^{331}\) Supreme Court has reiterated
the same stand taken in *Murarilal*'s case and held, court may vary in placing

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\(^{328}\) Illustration to Section 114 states that, an accomplice is unworthy of credit, unless he
is corroborated in material particulars.

\(^{329}\) Court referred *Ram Chandra v. State of U.P.*, AIR 1957 S.C. 381; *Ishwari Prasad


implicit reliance on the opinion evidence. The court said, no hard and fast rule
could be laid down in this behalf, but the court has to decide each case on its
own merits, what weight it should attach to the opinion of the expert.

Thus a careful peer in to the Indian rules regulating the admissibility of
scientific evidence reveal that Indian courts will normally ask corroboration if there
is any doubt in the reliability such evidence. From the comparative analysis
conducted in the foregoing pages it is submitted that the standard of corroboration in
India can be considered as an effective check against the intrusion of junk science
in to the trial system. This is an active safeguard against miscarriage of justice.
Considering the worthiness of the rule of corroboration in admitting scientific
evidence, the following recommendations are offered as possible means to
ensure maximum output in evaluating it:

1. Scientific evidence may be considered as evidence against the
accused on the question of guilt or innocence only if independent
evidence, either direct or circumstantial, has been introduced into
evidence that corroborates the essential facts in order to justify the
inference of its truth. Other uncorroborated scientific evidence that
would require corroboration may be used to supply this independent
evidence. The independent evidence employed to supply corroboration
of the scientific evidence must include evidence that is admissible
against the accused.

2. A strict burden of proof principle must be adopted in the case of proving
independent evidence. However, the independent evidence necessary
to establish corroboration need not be sufficient of itself to establish
beyond a reasonable doubt the facts provided by scientific evidence.
The independent evidence need raise only an inference of the reliability of the scientific evidence. The quality and quantity of such evidence will always depend on the complete satisfaction of the trial judge.

5. Conclusion

The report of the criminal miscarriage of justice cases in other jurisdictions, report of error rates of forensic laboratories and intentional forensic frauds.

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332 See, Bob Woffinden, “Ear print Landed Innocent Man in Jail for Murder; ‘Grotesque Miscarriage of Justice’ Resolved after Seven Years”, (2004) Guardian Unlimited, at http://www.guardian.co.uk/ (Expert earprint identification evidence given by a Dutch police man which was later found as fundamentally flawed put Mark Dallagher six years in penitentiary. The miscarriage was later detected and the conviction was abandoned with the help of DNA identification.); “Murder Conviction is Quashed”, (2002) BBC News, 15th August (David Asbury, who was jailed five years ago, was freed after the judges accepted that fingerprint evidence against him was unreliable.); Marcello Mega and Rajeev Syal, “Errors put wrong men in jail, says fingerprint specialist”, (2001) Electronic Telegraph, 26 August, at http://www.telegraph.co.uk/ (Britain’s leading fingerprint scientist has resigned from the Metropolitan Police in order to testify in court against what he believes is flimsy forensic evidence that has led to unsafe convictions. He believes, however, that fingerprint evidence taken by many forces is poorly recorded and logged - and is leading to wrongful convictions. He said to the media: “It did leave us in a precarious position, but it was the right thing to do. I have had doubts about many cases, but now I realise that there has been a slow degradation of standards within the force, and now men are being put into prison on less convincing forensic evidence.”); Carol Midgely, “Injustice Casts a Lifelong Shadow”, The Times, 7th June 2001 (Despite having alibis backed by witnesses, Mahmood Mattan, a young Somali sailor was convicted and hanged with the help of scientific evidence derived from microscopic flecks of blood on his shoes and relying the word of a Jamaican, who testified that he saw Mattan coming out of the crime scene. The conviction was set aside later by the Criminal Cases Review Commission, which was set up under the 1995 Criminal Appeal Act.); Bob Woffinden, “Justice isn't working”, New Statesman, December 2000, at www.newstatesman.co.uk/ (Danny McNamee, convicted of the 1982 Hyde Park bombing, spent 11 years in prison for a crime he didn’t commit. At the time of his successful appeal in December 1998, the dangers of convictions on the basis of misleading fingerprint evidence were highlighted.

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333 William C. Thompson and Michele Nethercott in their recently published article gave three good examples for forensic fraud: (1) Arnold Mellnikoff, former Director of the Montana State Crime Lab, gave scientifically unsound and intentionally misleading testimony about hair comparisons that falsely incriminated Jimmy Ray Bromgard (who was proven innocent by post-conviction DNA test). A panel of experts who reviewed the Bromgard evidence called for a comprehensive review of all of Mellnikoff’s work over three decades to look for other instances of scientific misconduct. (2) Joseph Serowik, Chief Serologist of the Cleveland Police Crime Lab, was accused of scientific fraud after his misleading testimony about a serology test falsely incriminated Michael Greene (who was proven innocent by post-conviction DNA test). As part of the settlement of a wrongful conviction law suit filed by Greene, the City of Cleveland agreed to appoint a special master to review work performed
made clear that the evidential value of scientific expert evidence should not be overestimated. Despite many arguments favouring scientific evidence in criminal trials, the fact, which could be traced from the judicial pronouncements, is that the prosecution and forensic experts in the courtroom often misuse it equally. An overview of the legal framework governing scientific testimony gives an ultimate suggestion that forensic testimony cannot be considered as better than eyewitness testimony and credibility battles. In 1843, an English judge rightly wrote that “skilled witness come with such a bias in their minds to support the case in which they are embarked that hardly any weight should be given to their evidence”.

The threadbare analysis conducted by the legal scholars in United States and England argued for more rigorous standards for the admissibility of scientific evidence. By researching the law and practise surrounding scientific evidence in other jurisdictions, Indians can either relinquish or accept their ideological and other baggage and gain insight in to some of the relevant issues that plague in India. For example, whether Indian judges are able to distinguish junk science from good scientific evidence? If they are not able, then what legal rules, if any, can be tailored that would be helpful to exclude pseudo scientific evidence in criminal trials.

by Serowik and some of his crime lab colleagues over a 17-year period. (3) James Bolding, former head of the DNA and Serology Section of the Houston Police Department Crime Laboratory, gave misleading testimony about a serology test that falsely incriminated George Rodriguez (who was proven innocent by post-conviction DNA test). A panel of experts who reviewed the Rodriguez evidence declared that Bolding was either grossly incompetent or guilty of perjury and called for a review of Bolding’s work in other cases. See, William C. Thompson and Michele Nethercott, “Feature: Forensics: The Challenge of Forensic Evidence”, 29 Champion 50 (2004); The Times of India reports that regarding the March 2000 issue in Anantanag, the Centre for DNA Fingerprinting and Diagnostics in Hyderabad did not initially report that DNA samples from the deceased failed to match those submitted by villagers claiming to be relatives. Rather they reported that results could not be obtained because the samples had clearly been tampered with. www1.timesofindia.com/articleshow.asp?art

Corroboration can be considered as an effective tool in checking the invasion of junk science into the legal system. No doubt, it will reduce the miscarriages of justice occurred in the criminal justice system through scientific evidence. However, it cannot be considered as an effective standard in evaluating scientific evidence as a replacement for the standards like Daubert and Frye. What a court must be on its guard against is to take maximum pain in evaluating the scientific evidence confronted before them in order to avoid the freedom for the guilty and incarceration for the innocent.