



FORENSIC TOXICOLOGY EXPERT WITNESS

HANDBOOK

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This is a handbook help facilitate the training of FTDTL scientists in forensic toxicology expert testimony. The information presented is a copulation of many years of testifying as an expert witness reading and researching information and listening to many experts and through conversations with Cliff, Peter, Jacqueline, Susan, Harold, Zinora, Cynthia, Abel, Etta, Jason and Michael.

As scientists we owe it to the judicial system to be scientifically correct and forensically sound.

Jacqueline Alice Jones, BSN, RN.



Though expert witnesses have been used for centuries in Europe, they were rare in the United States until the 1920s. The Supreme Court had been cautious in using experts and limited their cross-examination, which was perceived as a waste of time, exhausting and confusing to the court and jury instead of clarifying the issues at hand. In 1923, the United States made a decision that defined the basic prerequisite for admitting scientific evidence and, thus, testimony by expert witnesses.

When the forensic scientist testifies in court, both he and his testimony are usually evaluated by a group of people that has never seen him before and has little or no scientific background. These people, the jury, are exposed to the forensic scientist for only a relatively short time, during which they are privy to a strictly regulated question-an-answer conversation carried on between the scientists and the attorneys in the case. As a result of this exposure, the jurors must answer several important questions:

1. What did the expert say?
2. What is the significance of the expert's testimony?
3. Is the expert competent?
4. Is the expert honest?

It is essential for the forensic toxicologist to understand what the criminal justice system expects of the expert witness. The expert must realize that any tests, examinations, observations or experiments he performs may require testimony in the courtroom regardless of the results. Preparation for this responsibility begins the first day the expert enters the laboratory.

The forensic toxicologist prepares a report stating his findings in each case, but a report seldom contains all the information to prepare for trial. It is therefore essential for the expert to make detailed notes with respect to any information needed to supplement the report. We must always keep in mind that any analysis has the potential for courtroom testimony. Since yesterday's cryptic notes are today's undecipherable hieroglyphics, we must make a concerted effort to maintain detailed, clear, concise, accurate, and legible notes.

Sometimes the expert witness will have no independent recollection of a fact and request permission to refer to his notes. Once he refreshes his memory by looking at the notes, he then turns back to the trier of fact and continue testifying (*United States v. Ricardi*, 1949). Once the witness refers to his notes in court, the attorney for the opposing party has the right to see that portion of the notes (*Jackson v. United States*, 1958; *United States. Goldman*, 1941; *Shell Oil v. Pou*, 1967). This, like other aspects of cross-examination is to enable the opposing party to probe the recollection of a witness, to test his credibility, and even to impeach him" (*Hill v. Downs*, 1959). If the witness testifies for the government in a federal court he may be required to deliver his notes or a copy of them to the defense attorney upon the completion of the direct examination, even though the witness did not use his notes or a copy of them to refresh his memory upon the completion of direct examination, even though the witness did not use his notes to refresh his memory (18 U.S.C. 3500, 1970). In view of the possibility that these notes or a portion them may have to be turned over to the attorney representing the opposing party, it is incumbent upon the expert to make certain the notes accurately reflect the information or data concerning the evidence.

Chain of custody is familiar to all experts, but its importance should not be underestimated. From the moment a specimen collected until it is introduced in court, all persons having custody of the evidence must account for it. Tangible objects become admissible in evidence only when proof of their original acquisition and subsequent custody forges their connection with the accused. Many times the court has allowed me to submit the original specimen bottle without the biological specimen in it because of health and safety reasons. The law requires that "the possibilities of misidentification and adulteration be eliminated, not absolutely, but as a matter of reasonable probability" (*Gass v. United States*, 1969).

The admission of evidence in federal court is governed by the **Federal Rules of Evidence**. These rules were adopted in 1975 to provide a uniform guideline that specifically addresses the admissibility of evidence.

Rule 104(b) gives the scope of the judge's responsibility. It states that "the judge may admit evidence – which otherwise might be ruled irrelevant – contingent upon the fulfillment of a condition of fact or subject to the introduction of other evidence which establishes a fact."

Rule 401 says evidence is relevant if it 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. It must be pertinent to the issue in the case and is admitted only if it will help the jury make a decision. The burden of proof of relevancy rests on the party that will benefit from the introduction and the admission of the evidence. The opposing attorney may object to the potential evidence on the grounds that it is inadmissible or irrelevant. After hearing the positions offered by each attorney, the judge decide whether to admit the evidence or not. That decision is not based on the veracity or persuasiveness of the evidence, but only on the narrow question of whether the jury should be permitted to hear the testimony.

Rule 104 empowers the judge to admit evidence that seems irrelevant or inappropriate but that may prove to be relevant later in the proceeding, in the light of other evidence that has been admitted. For example, evidence that is hypothetical or based on conjecture, as opposed to evidence that describes something that actually happened, may still be admitted under Rule 104 if that evidence is based on the facts of the case and would be helpful to the jury in resolving the case.

Since Rule 104 vests the judge with the sole authority to determine the admissibility of evidence, it is the responsibility of the judge to determine whether to accept or reject the testimony of an expert witness based on Rule 702.

Rule 701 allows the admission of expert testimony only if the testimony will be helpful to the judge or jury in deciding the facts, and if the expert possesses appropriate qualifications to testify on the subject in which he or she purports to be an expert. To do this, the judge must analyze whether the expert's testimony is (1) sufficiently based on reliable facts on data (and not merely on hypothetical circumstances), (2) the product of reliable principles and methods, and (3) the result of a reliable application of those principles and methods to the facts.

The **Federal Rules of Evidence** characterizes the rules in the federal courts, and they are similar to rules enacted by many state courts. A review of some of the rules:

Rule 701. General reference for the use of scientific, technical, or specialized knowledge.

Rule 702 is a liberal approach to the admission of expert testimony if that testimony will assist the trier of fact to understand the evidence or determine an issue. This rule also sets forth a liberal standard to the question of who is an expert, leaving the determination to the discretion of the court.

Rule 704 shows you may give testimony on any ultimate issue to be decided by the trier of fact.

Rule 705 shows you may state your opinions and conclusions without first testifying to the underlying facts or data of your opinion unless the court requires you to do so.

Rule 16 (a)(I)(D) of the **Federal Rules of Criminal** procedure says that upon request the government shall permit the defendant to inspect or copy any results or reports and scientific tests which are within the possession, custody, or control of the government, the existence of which is known, or by the exercise of due diligence may become known, to the attorney for the government, and which are material to the preparation of the defense or are intended for use by the government as evidence at the trial. Since the report will be given to the attorney, who can use it on a cross- examination, the expert must write the report so that it reflects his opinion accurately.

Many times only limited discovery of the reports of defense experts is accorded to the prosecutor.

Rule 16(b)(1)(B) states that if the defendant requests disclosure under subdivision (a)(1)(C) or (D) of this rule, upon compliance with such request by the government, the defendant, on request of the government, shall permit the government to inspect and copy any results or reports and scientific tests made in connection with the particular case within the possession or control of the defendant, which the defendant intends to introduce as evidence at the trial or which were prepared by a witness whom the defendant intends to call at the trial when the results or reports relate to his testimony. The prosecution may not be able to obtain the defense expert's report as readily as the defense can obtain the prosecution's expert's report, but the defense expert should not be any less thorough in preparing his report. The prosecutor also can use the report when cross-examining the defense expert.

WHAT IS AN EXPERT WITNESS?

The Rules of Evidence recognize two categories of witnesses, lay witness and expert witness. Lay witnesses, also called fact witnesses, are called to testify because they have seen, heard, or done something relevant to the facts and circumstances of the case. The testimony of such witnesses contributes directly to establishing the factual events.

An expert witness is a person who, by reasons of education or special training, possesses knowledge of a particular subject that may be beyond the understanding of the average person. They are hired only if their expertise is necessary to present technical and/ or complex facts, or to provide expert opinions based upon their knowledge, experience, and qualifications.

The contribution of expert witnesses is not limited to their personal knowledge. Expert witnesses can draw inferences from ordinary science, business, or other technical areas. They may be asked to offer opinions on the cause or consequence of occurrences. They may even be called upon to interpret the actions of others and the impact of those actions liability. The opinions and observations of expert witnesses increase the probability of reaching a fair and just ruling because expert witnesses are able to explain facts that might otherwise escape notice and consideration. As a result, expert witnesses are most often challenged on the reliability of their interpretations of the facts and on the objectivity or bias of their testimony.

A popular misconception should be dispelled at the outset. Dramatic courtroom testimony is not the only use made of experts. You may be engaged for arbitration, consultation, administrative hearings, long-time planning or internal investigation.

There are consulting experts and testifying experts, the distinction between the two is critical because it has an impact on the disclosure of information, thoughts, and processes. Consulting experts provide background knowledge and lend their expertise outside of the courtroom. A consulting expert will not be called as a witness. Testifying experts, on the other hand, go beyond the support provided by consulting experts and ultimately assist the lawyers trying a case by providing testimony either in court or in depositions.

This distinction between a testifying expert and a consulting expert is important because the identity and opinions of testifying experts must be revealed to the opposing party in advance in trial if properly requested. This means the opposing side will have access to the experts and their records and, therefore, be better able to prepare a response.

PRETRIAL PREPARATION

A cautionary word is in order. Attorneys in our system are advocates, relics of the champions of jousting fields of the past. As such, their duty is to put forth a set of facts and proofs that support the client's position. It is not improper for the advocate to give you a wish list stating the most desirable conclusions from the attorney's and client's viewpoint. This does not mean that you must support that view. Your integrity, reputation, and personal and professional self-esteem require that the conclusions you reach and opinions you espouse be supportable based on the available body of facts and operative knowledge. Follow the scientific method regardless of the path it forces you to take.

A pretrial conference between the expert and the attorney who presents him as a witness is essential. Failure to prepare for trial with the attorney can lead to embarrassing moments for the expert on the witness stand. Lack of preparation combined with a good cross examination may make the expert witness appear less than an expert. Even one weak performance on the witness stand may return to haunt the expert in a subsequent trial. One reason for having the pretrial conference is to educate the attorney in the relevant field of forensic science and thereby help the attorney to present the forensic evidence better in the courtroom. The expert should be prepared to suggest or provide the attorney with books, articles, or other materials that might facilitate the attorney's presentation of the case in the court. At the pretrial conference the attorney and the expert should discuss the expert's qualifications and the questions that will be asked in court to establish those qualifications. The expected demeanor of the expert on the witness stand should be reviewed. The questions to be asked on direct examination and the anticipated cross examination should be discussed thoroughly. The expert can help the attorney to formulate the appropriate questions on direct examination and the attorney can help prepare the expert to respond to the cross examination.

All terms used by the expert and the attorney should be mutually clear and understandable. The chain of custody for each item should be reviewed. Any legal issues that may affect the expert's testimony should be discussed. The expert should be advised by counsel about any idiosyncrasies of the trial judge or the opposite attorney that may have some bearing on his testimony. If the opposing attorney intends to present a forensic scientist in the same field, the expert can assist the attorney in preparing for the cross examination of that witness. Many times the expert witness is not cross examined thoroughly, but he should be prepared for the most extensive cross examination. The expert's preparation for trial therefore should also include a review of the history of the particular field of forensic science, the pertinent literature, the recent developments, and methods currently in use in the fields, since these are possible areas into which the cross – examiner may delve. Anything the expert has written in his area of obviously requires review.

Courts expect experts to be confident, persuasive, and impartial, yet not boastful or contentious. They want experts who are firm, with strength of conviction. They need experts who will explain technical, complex matters in a way that the jury fully understands and to which jurors can relate. Courts also want experts with appropriate credentials to support narrowly tailored opinions. While communication and teaching skills may be more important than credentials for a testifying expert, outstanding expertise and analytical ability may be more important than the ability to communicate and teach for a consulting expert. Thus, the expectations will change depending on how the expert will be used.

Attorneys should respect the ethics and professional integrity of the expert and not demand that all opinions be slanted in order to bolster the case. Experts need lawyers to clearly describe and explain the interrelationships between their testimonies and those of other experts involved in the case so the experts can prepare to explain conflicts of opinion. Legal definitions should be explained by the attorney.

Examples of definitions

Beyond a reasonable doubt

Part of jury instructions in all criminal trials, in which the jurors are told that they can only find the defendant guilty if they are convinced "beyond a reasonable doubt" of his or her guilt. Sometimes referred to as "to a moral certainty," the phrase is fraught with uncertainty as to meaning, but try: "you better be damned sure." By comparison it is meant to be a tougher standard than "preponderance of the evidence," used as a test to give judgment to a plaintiff in a civil (non-criminal) case.

Preponderance of the evidence

The greater weight of the evidence required in a civil (non-criminal) lawsuit for the trier of fact (jury or judge without a jury) to decide in favor of one side or the other. This preponderance is based on the more convincing evidence and its probable truth or accuracy, and not on the amount of evidence. Thus, one clearly knowledgeable witness may provide a preponderance of evidence over a dozen witnesses with hazy testimony, or a signed agreement with definite terms may outweigh opinions or speculation about what the parties intended. Preponderance of the evidence is required in a civil case and is contrasted with "beyond a reasonable doubt," which is the more severe test of evidence required to convict in a criminal trial. No matter what the definition stated in various legal opinions, the meaning is somewhat subjective.

Scientific Certainty

In trial and deposition, I have been asked the question: Are you requiring scientific or legal certainty? This question arises in the context of a causal assessment in, for example, a toxic tort or pharmaceutical liability claim. The question is designed to be a "gotcha." Why? Because most attorneys believe that scientific certainty is more rigorous (i.e., 95%) than legal certainty (more probable than not, or 51%). While some attorneys believe there is truth to that comparison, the question actually compares apples to oranges.

“Scientific certainty, that an event can occur as a result of a precedent event or trigger (Influenza A virus causes the flu) or that a relationship exists between two variables, is needed for the initial aspect of a causal assessment. Legal certainty is required for a different aspect. Thus, far from a “gotcha,” this question illustrates a common misunderstanding or misapplication regarding the utilization of probability tools to the respective issues: scientific certainty versus legal certainty.

“Scientific certainty (that A can cause B) should be established before legal certainty (that A did cause B). The legal certainty question comes into play when there are many potential variables that have been proven to cause a similar result, and you are trying to determine which one actually caused the event.

“Scientific certainties (actually scientists don’t use this legal term of art, but I shall explain it from an attorney’s point of view), are a reflection of the quality of the underlying data. In other words, are the studies that underlie the claim at issue valid, statistically significant and accepted by the scientific community? Statistically, is there a scientifically-accepted likelihood that an observed relationship is simply not due to chance? That is where the 95% confidence number comes from. A “p” value of 0.05, by convention the cutoff between statistically significant and not, is that 95% likelihood. But that percentage applies only to one of the quality criteria as to whether the science used to assess causality in a claim.

“The “gotcha” scenario of implying scientific certainty can be diluted, yet still scientifically valid, is ludicrous. In fact, if a study showed only a 51% likelihood of reflecting a true relationship rather than a chance relationship, then no scientist, no regulatory body, no one who reviews scientific data, would consider that study indicative of any causal relationship. A 51% outcome would not even merit a follow up or “validation” study by the scientific community. In the words of legalese: “The relevant scientific community would consider the use of such a study methodologically improper.”

From: [http://phys4.harvard.edu/~wilson/soundscience/Scientific v.Legal.pdf](http://phys4.harvard.edu/~wilson/soundscience/Scientific_v.Legal.pdf)

COURTROOM DEMEANOR

As is the case with other witnesses, the expert as a witness will be judged by the jury in part by his demeanor on the witness stand. The demeanor of the witness includes: such factors as the tone of voice in which a witness' statement is made, the hesitation or readiness with which his answers are given, the look of the witness, his carriage, his evidence of surprise, his gestures, his zeal, his being, his expression, his yawns, the use of his eyes, his furtive or meaning glances, or his shrugs, the pitch of his voice, his self-possession or embarrassment, his air of candor or seeming levity (Rains v. Rains, 1939)

Once the expert is sworn under oath, he must realize that his demeanor on the witness stand may mean the difference between the jury's accepting or rejecting his testimony.

While on the witness stand the expert should focus his attention on the jurors, since they will decide the facts in the case. Direct eye contact with the jurors during the testimony is important. The attorney doing the direct examination should stand in a position that does not interfere with the relationship between the witness and the jurors. The expert must be careful not to allow the opposing attorney to divert his attention away from the jurors on cross-examination.

As far as the expert's manner of testifying is concerned, good approach is for the expert to testify as if he were having a normal conversation with the jurors; that is, the expert is in court just to share his knowledge and expertise with the jurors to help them decide the facts. The expert should appear confident in his opinion without being pedantic or arrogant.

Conservative street attire must be worn in the courtroom. Clothing should not distract the attention of the juror from the witness testimony. A neat appearance gives a favorable impression. Good posture should also be maintained. A good neat haircut is a must. Jewelry should be sparse. If you wear glasses you have an advantage and graying hair is also considered an asset.

The presence of a brown plain folder to carry your papers is just the element of plebian to enhance your understated professional elegance and neutrality.

You should stay out of the courtroom unless you need to hear testimony for rebuttal (the judge or attorney will guide you). Absence from the courtroom until called to testify may give the appearance of impartiality and gives you the ability to decline comment on any prior testimony which may have been offered.

QUALIFYING THE EXPERT IN COURT

The expert must first be found qualified by the judge in his particular field of forensic science before he is allowed to present his opinion in court. The trial judge has a broad discretion in determining whether to accept or reject the qualifications of the expert (United States v. Sellaro, 1973; Jenkins v. United States, 1962; State v. Clark, 1976). Some of the factors the judge will consider include education, on-the-job-training, experience in the field, teaching or lecturing, and writings. The judge will also take into consideration whether the expert has been found qualified previously by other judges. Therefore, once the expert is first qualified as a witness in any court, it is a good idea for the expert to keep a record of each time he has been found qualified and each court in which he had testified.

Examination of the expert as to his qualifications normally occurs in the presence of the jury. However, at the request of the attorney representing the opposing party, the trial judge may cause the expert's qualifications to be initially determined outside the jury's presence. The attorney who requests this procedure does so for two possible reasons. First, the attorney may think he has a chance of preventing the witness from being qualified as expert, and if that is what occurs, the jury will not hear any testimony from the expert. Second, the attorney will know not to repeat these questions in front of the jury. Of course, only the first reason is mentioned by the attorney when requesting a voir dire examination outside the jury's presence. If the trial judge finds the expert qualified, the jury will be returned to the courtroom and the expert will then be asked to state his qualifications again.

The manner in which the attorney seeks to qualify his own witness as an expert will vary from case to case. If the attorney presents an expert who has been qualified in a hundred previous trials, the attorney will ask certain questions that he would not ask if this were the expert's first attempt to be qualified in court. A fingerprint examiner will be questioned in a different manner than the forensic toxicologist. Whatever questions are asked in an effort to qualify the witness as an expert, sufficient information must be elicited so that the judge and the jury will know he is capable of giving in that particular field of forensic science.

To keep the jury from hearing how qualified an expert may be, the attorney representing the opposing side may be willing to stipulate to the expert's qualifications may save time but it is not usually a good idea. The qualifications-testimony is an essential part of the expert's testimony and in some cases may be half the battle. The jury will look at the expert's qualifications in determining the weight to be given to his opinion. The expert with excellent credentials will impress the jury and make it that much easier for the jury to credit his opinion.

DIRECT EXAMINATION

Direct examination provides the expert with the opportunity to use his training, experience, and knowledge to describe to the jury how he reached an opinion based on certain facts. Care must be exercised at this point, since the findings of the greatest forensic scientist in the field will be of no value to anyone in the courtroom if he is unable to relate his finds to the jury.

Most jurors and judges have had little, if any background in the forensic sciences. The language used by the toxicologist should be readily understandable to the layperson and not abstruse or incomprehensible. If scientific terms are used, they should be explained for all to understand. Photographs or other exhibits may be used to demonstrate what the expert is trying to explain. Drawing analogies between scientific principles or testing procedures and commonplace events in a juror's life may make it easier for the jurors to understand the basis for the expert's opinion. Above all, the expert witness must always be alert to whether the jurors are paying attention to and comprehending his testimony. If the expert witness senses he is losing the jurors, he must make every effort to regain their attention.

The expert witness can express his opinion in response to a direct question or a hypothetical question. A direct question requires the witness to state his opinion based on his observations and tests or examinations performed by him. Since most laboratory tests are complex, the witness should not mention every detail of every test performed and risk confusing the jury or distracting the jury's attention from the key points of the opinion. Rather, it may be sufficient for the witness to describe generally the tests performed or to testify that he performed the standard tests recognized in the field for examining this type of evidence. The witness should wait for the cross-examiner to bore the jury by eliciting all the details of the tests.

A hypothetical question requires the expert to give an opinion based on a number of assumed facts. The attorney asking the expert to express his opinion in response to a hypothetical question will begin the question by stating; "Mr. Expert, assume for the purposes of this question that the following facts are true." Then the attorney will state number of facts that have been introduced in evidence during the trial and ask the expert to give an opinion based on these facts. The use of the hypothetical question to elicit an opinion has been criticized by the courts.

CROSS-EXAMINATION

The feeling exists among some experts that the cross-examiner is bent only on attacking the expert personally. The well-prepared expert can handle cross-examination. Cross examination is the most misunderstood aspect of the adversary system. It need not be a fearful experience for you. Cross-examination will allow you to solidify the impression you left through your prior testimony. Be honest. Follow the skilled, technical, professional, or scientific method. The same respect must be shown to the defense counsel as to the prosecutor. Always look at the defense counsel while he asks questions, then with a hesitation which does not exceed in length the hesitation during questioning from the prosecutor, turn to the jury and give your answer. If you cannot give a clear, concise, and honest answer to the question of the defense attorney, then say so and explain why you can't. Long complicated questions can sometimes be answered in sections – again say that you are answering each portion of the question in turn. If the defense attorney insists on a “yes” or “no” answer to his question that cannot be honestly answered with a “yes” or “no” – then say so clearly. You may say “please let me explain”. Most questions may be as YES, NO, I don't know, I don't remember, I don't understand the question, or by a SIMPLE FACTUAL ANSWER. Avoid such phrases as, I think, I believe or I assume. Be careful of trap words such as absolutely or positively. If scientific or technical information is involved give specifics.

If you encounter a defense attorney who employs the tactic of staring at you after the question is answered as though he expected more to come, he is making an attempt to provoke the witness into volunteering additional information. If you are satisfied that you have thoroughly answered the question asked, then let him stare and wait for the next question.

How do you handle questions taken from reference works when they are out of context. Unless you are totally familiar with the text, you should avoid comment until you ask to see the text and have a chance to read the source from which the phrase or question is taken. [Beware: ask to see the actual book, not a Xerox copy, etc.

Avoid being swept along by the defense attorney [or prosecutor for the matter] into arrears outside of your expertise. This is a simple, but deadly, trap this is used to very unpleasant effect by many talented defenders. Avoid this like the plague! If it can be shown that you are testifying outside your area of expertise, it will reflect to such a degree on the testimony within your expertise that everything may be thrown out of court. Even worst, false testimony such as this at one trial may be cited in appeals in other trials where you made no attempt to go beyond your knowledge and abilities. The final result can be a career gone down in flames.

There are some basic principles that the expert should adhere to during cross-examination. The expert may be asked a question for which he does not know the answer, or for which there is no answer. If this type of question is asked, the expert should state that he cannot answer the question or that the question cannot be answered, and explain.

Guessing will only lead to trouble. The expert should not answer a question that he does not understand. If the question is unclear, the expert should tell the attorney he does not understand the question. Though all questions must be answered, supplementary information should not be volunteered and the expert should be careful not to talk too much.

A question may be asked by the cross-examiner that included facts that do not reflect accurately the witness' testimony in direct examination. Before answering the question, the witness should correct the misstatement and reiterate the facts previously stated. The witness should not permit the opposing attorney to put words in his mouth.

There may come a time when the expert recognizes before a trial or during a trial that he has made a mistake that could have affected his opinion. In this instance, the forensic expert should be honest and admit it on the witness stand. Though some damage may be done to his reputation, it will be far worse if the expert attempts to cover up the mistake. Admitting to the mistake may even have the effect on enhancing the expert's reputation for honesty. After all, experts are human too! Obviously, the expert should make certain the same mistake does not occur a second time.

An attorney may intentionally or unintentionally cross-examine the expert by using worked or terms that mean something different to the attorney than to the expert. In these instances, responding to questions couched in terms used by the cross-examiner to define words or terms that may be of uncertain meaning to the expert will enable the expert to maintain some control over the cross-examination as long as he does not do it too often and risk alienating the jury.

All witnesses, including experts, are subject to cross-examination as to bias, interest, or motive to fabricate testimony. The impartial attitude of the expert is also important in this area of questioning, since the jury will be less likely to believe that an expert who appears to be impartial is actually biased. One who testifies as if he were an advocate for the side presenting him as a witness may be distrusted by a jury. If the expert is employed by and is testifying on behalf of the government, the questioning on bias probably will center around these questions: (1) that the expert is employed by the government in a continuing capacity to testify as an expert, (2) that the expert can expect a steady paycheck as long as he does a good job for the government, (3) that the expert probably does not do any testing for defendants, (4) that the expert testifies only for the government or most of the time for the government, and (5) that the expert would not meet with the attorney prior the trial. An independent expert who has testified for the government or the defense probably will be questioned about bias in a similar manner; (1) that the expert testifies far more for one side than the other, (2) that the expert prefers working on cases for one particular side because of his personal feelings, (3) that money is a prime concern to the experts and he will charge s much as he can and (4) that he is being paid for his testimony in the case. All these and related questions asked by the attorney to show the expert is biased can readily be answered and explained by the expert who understands the important of the questions and is prepared to respond to them.

Remember always that you are not there to “win” the case – you are there to lend your expertise to aid the jury in understanding your work and results.

The expert must be certain he understands all the assumed facts in the question and what opinion the cross-examiner is attempting to elicit from him before answering the question. If the expert feels he cannot answer the question posed, he must indicate this is his response.

You have ample opportunity to stay current and competent in your professional scientific field. You owe that duty to yourself, your profession, your client and the judicial system. Maintain your skills and knowledge. Growth, maturity, and success in forensic testimony does not come easily

Key Cases and Precedents Affecting Expert Witnessing

Frye v. United States 293F. 1013 (D.C. 1923)

Frye v. United States delineated the threshold requirement for the admissibility of scientific evidence; this requirement became the standard recognized by most courts for the seventy years. In *Frye*, the defendant was accused of second-degree murder. The defense attorney offered the testimony of an expert witness to administer and interpret the results of a polygraph test. At that time, the polygraph test was conducted by measuring changes in the blood pressure of the subject as he or she answered a variety of questions. If the subject responded truthfully, there would be negligible change in blood pressure; if not, the polygraph would record a spike or dramatic change. The *Frye* defendant sought the admission of polygraph results to prove that he had not committed the crime.

On appeal, the Circuit Court held that expert testimony is admissible only if founded on methods, principles, and procedures agreed upon as valid by the scientific community. The court refused to admit the expert's testimony or the polygraph test, stating that, "while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the methodology from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs." Although the *Frye* defendant lost his bid to admit polygraph results, the "general acceptance" test articulated in the case opened the door for the use of scientific evidence and expert witnesses throughout the U.S. court system.

The Frye Test requires the trial court to consider two factors before admitting expert testimony. First, the court must identify the witness's expertise in a specific field of science. An individual can be considered an expert if he or she possesses the requisite education, experience, and recognizable contribution to the field, as demonstrated through activities such as the publication of peer-reviewed articles. If the witness qualifies as an expert, the second step is for the court to determine whether methods, theories, and conclusions of the expert meet the "general acceptance" standard.

The Frye Test emphasized the consensus of the scientific community in determining the validity of scientific method. Consensus is reached when scientists evaluate the quality of a proposed scientific theory through peer review, publication, criticism, replication, and determination of reliability in predicting future results. In expressly limiting the admission of scientific evidence to that accepted in the general scientific community, the *Frye* court left no room for new, emerging, or novel scientific theories that might support a party's claim.

While the Frye Test helped define both who is an expert and what expert testimony is admissible, it was not without its problems. Key among these problems was that science is always changing; what is "generally accepted" in the scientific community is always subject to change as new theories and principles emerge. However, under most interpretations of the *Frye* standard, novel scientific theories and techniques could be deemed inadmissible, even when the expert offering the testimony possessed excellent credentials, simply because that theory was not generally accepted by the relevant scientific community.

When the Federal Rules of Evidence were adopted in 1975, the Rules Committee declined to incorporate the Frye Test in the rule governing the admissibility of expert testimony. Instead, the Rules allow the admission of testimony by experts "if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact." Nonetheless, approximately half of all states continued to apply the Frye Test to determine whether to admit the testimony of an expert witness in a scientific or technical field. Proponents contended that the "general acceptance" standard established by *Frye* ensured reliability of evidence based on established science, promoted uniformity of decisions, and expedited the trial process by reducing arguments concerning the admissibility and reliability of testimony. Through the application of the Frye Test, judges, most of whom are not scientifically trained, did not have

to look very closely at the scientific methodologies proffered by an expert and could defer to the scientific community on questions of general acceptance.

Even though the Frye Test was ostensibly rejected when the Rules of Evidence were adopted, it was another eighteen years before the United States Supreme Court squarely addressed what standard governed the admission of scientific and technical evidence in federal court. In the interim, federal courts were left to exercise their discretion. Rules 701 and 702 provided only the broadest of parameters for the admission of scientific evidence, with no further guidance in the Committee Notes to the Rules. Some courts, faced with ambiguities of the rules, continued to rely on *Frye*.

One example is the class action lawsuit filed on behalf of 15,000 Vietnam War veterans who had been exposed to the chemical defoliant Agent Orange. A relationship between Agent Orange and the medical symptoms and maladies experienced by Vietnam veterans was shown in toxicological studies conducted on animals. However, epidemiological studies did not indicate causation by Agent Orange. The judge, after screening and evaluating the scientific evidence presented by experts prior to the trial, ruled that the results of the animal and toxicological studies were inadmissible as evidence because the science did not meet the minimum standards of reliability.

In a vast departure from the prevailing Frye Test, the judge made an independent assessment of the reliability of the proffered scientific evidence, rather than relying solely on whether the methodologies used and conclusions drawn by the experts were “generally accepted” in the scientific community. This case foreshadowed reforms in the law concerning scientific evidence and expert testimony, triggered primarily by two factors: the restrictiveness of the Frye Test and the need to ensure that scientific evidence admitted in court was reliable and relevant, even if not “generally accepted.”

In 1993, the United States Supreme Court decided *Daubert v. Merrill Dow Pharmaceuticals*, one of the most influential cases to set the standard for the admission of scientific evidence in light of the Federal Rule of Evidence. In *Daubert*, the plaintiffs claimed that their infants' birth defects were the result of the mothers ingesting Bendectin, a drug manufactured by Merrill Dow, to combat the symptoms of morning sickness. At the time, Bendectin was very popular and was prescribed for pregnant women almost as commonly as vitamins. From 1958 to 1983, more than 17 million women took Bendectin, considered by the drug manufacturer to be a relatively safe and effective drug. At the time of the suit, more than thirty published studies indicated that Bendectin did not cause birth defects in unborn babies.

However, the plaintiffs' attorneys presented the testimony of eight experts who claimed that Bendectin did cause birth defects. The testimony of these eight experts was based upon science that included reworked epidemiological statistics, plus animal and toxicological studies, showing that the chemical structures of the drug were similar to those of other chemicals known to cause birth defects. The defense argued that the reanalysis of statistical data had not been published or subjected to peer review and, therefore, was not generally accepted by the scientific community. The court rejected the toxicological evidence and dismissed the plaintiffs' case on summary judgment. On appeal, the court affirmed the decision, finding that the unpublished statistical reanalysis of previously published studies was problematic because the reliability of a scientific technique does not vary according to the circumstances of each case.

The Supreme Court then heard the case and, for the first time, rejected *Frye* as the sole standard for the admissibility of scientific evidence. Noting the passage of the Federal Rules of Evidence, the Court held it was within the purview of trial judges to exercise their discretion in admitting expert testimony; trial courts were, in effect, “gatekeepers” for such admissions. The Court further held that the gate keeping required a case-by-case evaluation of the admissibility of an expert's testimony. The Court identified four factors courts should use to determine the reliability of scientific expert opinions:

1. The science can and has been tested.
2. The science has been subjected to peer review and publication.
3. The known or potential error rate of the science.
4. The general acceptance of the science in the relevant scientific community.

While these factors were intended to be non-exhaustive, federal courts have by and large applied them to the admission of expert testimony without regard to other factors. These criteria have become the “*Daubert Test*.” Over the years, the body of law developed since *Daubert* has elucidated the meaning of the factors.

1. *The science can and has been tested.* This factor has been interpreted to mean that the theory upon which the science relies has been verified through the scientific method in the laboratory, in the field, or both. Data must have been collected, analyzed, and related back to scientific theory. Others must have tested the theory and found under what conditions it was valid. Any algorithm or model based on scientific theory can be used as long as it meets these conditions.
2. *The science has been subjected to peer review and publication.* The reliability of the science must be proven through literature published in peer-reviewed journals. Peer review is generally defined as a process by which the manuscript is sent to reviewers in the relevant field. To be published, the manuscript must satisfy the reviewers. The decision to publish a paper is typically based on the soundness of the science and its impact in the field. Professional textbooks, government publications, and articles in journals fall in this category. Peer-reviewed abstracts and papers given at conferences (and published in the proceedings) fall in a gray area. Studies and reports not sent out for external scrutiny and publication are not considered peer-reviewed.
3. *The known or potential error rate of the science.* “error rate” is the expected error associated with a scientific method or technique, based upon available data, applied data, and the testing environment. It can be described in various ways, such as error percentages, statistical confidence levels, units of plausibility, boundary conditions, etc. Just because a technique may have a high error rate does not mean it is unreliable. Error rates, to some degree, represent the state of knowledge in a particular area on available data. Thus, error rates must be examined in context of the scientific area applied and the degree of certainty or correlation necessary to form a reliable expert opinion.
4. *The general acceptance of the science in the relevant scientific community.* This factor echoes the standard for admission that prevailed for so long under *Frye*. It is attributed to the weight members of the relevant scientific community give the evidence, based on their consensus of what is acceptable science and under what condition. Novel science in any field is always being developed, while old science is always in the process of being challenged, modified, and made obsolete. The general acceptance factor can be a severe limitation in the courtroom because the new science may in fact be better, more reliable, and more relevant than the old science. Under *Daubert*, general acceptance is not definitive; it is expected to be applied by the courts as one of many factors. The judge has the discretion to allow new science as long as it can be shown that it is demonstratively better and meets other criteria, such as peer review.

