Federal Judicial Center

Reference Manual on Scientific Evidence

For Use With
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Reference Manual on Scientific Evidence

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Preface

The Reference Manual on Scientific Evidence is the product of a cooperative effort by the Federal Judicial Center and the Carnegie Corporation of New York. The Center began its work on a manual to help federal judges deal with scientific evidence in 1990, shortly after the Federal Courts Study Committee recommended the preparation of such a manual. This work was done in furtherance of Center education programs on the subject; the purpose of the manual is to round out the Center's education effort in the area of scientific evidence.

The Center received substantial encouragement from the Task Force on Judicial and Regulatory Decision Making of the Carnegie Commission on Science, Technology, and Government. The interest of the Carnegie Corporation in furthering judicial education in the area of scientific evidence led to the establishment by the Center of a comprehensive program to develop the manual and produce related education programs. Funding by the Carnegie Corporation enabled the Center to support distinguished outside authors to prepare the papers and to have these papers reviewed by experts in science and its use as evidence in litigation.

We are grateful for the encouragement and support by David A. Hamburg, president of the Carnegie Corporation of New York, William T. Golden and Joshua Lederberg, co-chairs of the Carnegie Commission, and David Z. Robinson, executive director of the Carnegie Commission. We have benefited greatly from the advice of Helene Kaplan, chair of the Task Force on Judicial and Regulatory Decision Making. Steven Gallagher and David Beckler also provided valuable encouragement and assistance. We are especially grateful to the authors of the manual for their dedication, and to the many reviewers for their thoughtful suggestions. We would like to thank the staff of the Center's Information Services Office, in particular Rozzie Bell for helping us locate much source material. Finally, we have profited from the advice and assistance of the following members of the Center's Publications & Media Division: Susanna Carey, Geoff Erwin, Amy Hollander, Martha Kendall, and Kris Markarian.

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Introduction

The purpose of this manual is to assist judges in managing expert evidence, primarily in cases involving issues of science or technology. Such issues may arise across the entire spectrum of litigation: from mass toxic tort and product liability cases to patent and trademark cases, from medical malpractice cases to contract cases, from environmental, security, and antitrust cases even to criminal cases. The context in which they arise varies widely, but generally they share one characteristic: They challenge the ability of judges and juries to comprehend the issues—and the evidence—and to deal with them in informed and effective ways. As a result, they tend to complicate the litigation, increase expense and delay, and jeopardize the quality of judicial and jury decision making.

Expert evidence[1] has, of course, long been a part of judicial proceedings. People qualified by skill, knowledge, education, or experience have been permitted to testify to help the trier of fact understand the evidence or determine a fact in issue. Increasingly, however, the issues coming before courts are more esoteric and complex. As a result, the resolution of such issues has become more dependent on the help of experts. No longer can judges and jurors rely on their common sense and experience in evaluating the testimony of many experts, as they could when evaluating the testimony of, say, a handwriting expert or an accident reconstructionist. Now they must assess expert testimony on such arcane subjects as the impact of altering genetic material, the toxic quality of little-known substances, the similarity of computer operating systems, and the matching of DNA samples. The challenge the justice system faces is to adapt its process to enable the participants to deal with this kind of evidence fairly and efficiently and to render informed decisions.

The bedrock of that system is the adversary process, which depends on attorneys to present evidence on behalf of their clients, judges to make the necessary and appropriate rulings concerning admissibility, and juries to resolve disputed issues of fact. But when the adversary process yields conflicting testimony on complicated and unfamiliar issues and the participants cannot fully understand the nature of the dispute, courts may not be competent to make reasoned and principled decisions. Concern over this problem led the Carnegie Commission

1. The manual uses the inclusive term *expert evidence* to cover both testimony and nontestimonial evidence, such as demonstrative evidence presented by experts.

on Science, Technology, and Government to undertake a study of science and technology in judicial decision making. In the introduction to its final report, the Commission concluded:

> The courts' ability to handle complex science-rich cases has recently been called into question, with widespread allegations that the judicial system is increasingly unable to manage and adjudicate science and technology (S & T) issues. Critics have objected that judges cannot make appropriate decisions because they lack technical training, that jurors do not comprehend the complexity of the evidence they are supposed to analyze, and that the expert witnesses on whom the system relies are mercenaries whose biased testimony frequently produces erroneous and inconsistent determinations. If these claims go unanswered, or are not dealt with, confidence in the judiciary will be undermined as the public becomes convinced that the courts as now constituted are incapable of correctly resolving some of the most pressing legal issues of our day.[2]

One need not fully share the opinions of critics to appreciate the existence of a problem that affects the administration of justice in the decision of particular cases and in the larger dimension of the public's perception of the courts. In 1990 the Federal Courts Study Committee, appointed by the Chief Justice to study the federal courts, noted the increasing importance of economic, statistical, technological, and scientific data and recommended that the judiciary enhance its ability to manage and adjudicate cases involving scientific and technological complexity. The committee specifically recommended that the Federal Judicial Center prepare a manual to assist judges in managing such cases.[3]

The recent decision by the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*[4] has heightened the need for judicial awareness of scientific reasoning and methods. In *Daubert* the Supreme Court held that Rule 702 of the Federal Rules of Evidence requires that to be admissible as "scientific knowledge," scientific testimony "must be derived by the scientific method."[5] "Evidentiary reliability," it explained, "will be based upon scientific validity."[6] The trial judge is assigned a "gatekeeping responsibility" to make "a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue."[7]

Such a standard demands an understanding by judges of the principles and methods that underlie scientific studies and the reasoning on which expert evidence is based. This is a task for which few judges are adequately prepared when they arrive on the bench. Without a background in the sciences, many judges

2. Carnegie Comm'n on Science, Technology, & Gov't, Science and Technology in Judicial Decision Making: Creating Opportunities and Meeting Challenges 11 (1993).
3. Federal Courts Study Comm., Report of the Federal Courts Study Committee 97 (1990).
4. 113 S. Ct. 2786 (1993).
5. *Id.* at 2795.
6. *Id.* at 2795 n.9 (emphasis omitted).
7. *Id.* at 2795 n.7, 2796.

find it difficult to master the many areas of expert evidence without neglecting the needs of the remainder of their caseload. This manual is intended to provide judges with quick access to information on specific areas of science in a form that will be useful in dealing with disputes among experts.

The manual is divided into three parts. The first part concerns management and admissibility of expert evidence. The paper on management of expert evidence addresses the need for early awareness of issues about which experts will testify and suggests several strategies under the recently amended Federal Rules of Civil Procedure for assessing the needs of the case, defining and narrowing issues addressed by expert evidence, controlling discovery of experts, and resolving before trial questions concerning admissibility of expert evidence.

The second paper in this part presents a framework for considering challenges to expert evidence by structuring the requirements of the Federal Rules of Evidence into four questions: (1) Is the expert qualified? (2) Is the expert's opinion supported by scientific reasoning or methodology? (3) Is the expert's opinion supported by reliable data? and (4) Is the expert's opinion so confusing or prejudicial that it should be excluded pursuant to Rule 403? This paper also notes emerging issues that courts may be called on to address as they seek to implement the standards of the *Daubert* decision.

The second and most novel part of the manual is composed of reference guides for seven areas of expert testimony—epidemiology, toxicology, survey research, forensic analysis of DNA, statistical inference, multiple regression analysis, and estimation of economic loss. The reference guides are intended to assist judges in identifying the issues most commonly in dispute in these selected areas and in reaching an informed and reasoned assessment concerning the basis of expert evidence. The reference guides do not instruct judges concerning the admissibility of specific types of expert evidence or conclusions of specific scientific studies, and they are not intended to establish minimum standards for acceptable scientific testimony. Instead, they present a primer on the methods and reasoning of selected areas of scientific evidence and suggest a series of questions that will enable judges to identify issues that are likely to be disputed among experts and to explore the underlying basis of proffered evidence. Citations in the guides identify cases in which specific issues were raised to give judges examples of other instances in which judges were faced with similar problems; each guide also contains a list of recommended references.

The authors of the reference guides were selected for their knowledge of substantive areas of science and an awareness of the use of the science as evidence in litigation. The reference guides will be most useful when used as the basis for defining disputes underlying expert evidence. They may be used to aid in the identification and narrowing of disputed issues before trial, to facilitate rulings on the admissibility of expert evidence during a pretrial proceeding, or to help in the drafting of jury instructions.

For example, the Reference Guide on Forensic DNA Evidence identifies five pivotal issues and their material elements: the acceptance of the theory and technique of DNA analysis, the quantity and quality of the DNA sample, the performance of the specific sample analysis, the technique used to establish a match in DNA samples, and the statistical method used to estimate the probability of a random match. The judge will be able to use this outline to narrow the dispute, focus the lawyers' arguments, and come to a speedier and more informed ruling.

To inform the parties of the issues the judge is considering, the judge may want to distribute copies of relevant sections of the reference guide. This will also enable parties to direct the judge's attention to issues they believe should be considered, to supplement the material with more recent and specific information, to object to questions that are irrelevant or fail to account for recent developments, and to retain control over the presentation of critical evidence.

These reference guides should not be viewed as science textbooks. They serve the more limited purpose of outlining issues that may arise in litigation and improving the quality of the dialogue between the judge and the parties concerning the basis of scientific evidence. Nor should this manual diminish the role of the jury. The substantive law concerning the standards for the admission of expert evidence is still evolving as the courts interpret and apply *Daubert*. This manual is intended to aid the courts in this process.

The third part of the manual concerns the use of two extraordinary procedures to assist in problems of expert evidence—court-appointed experts and special masters. The Supreme Court in *Daubert* mentioned court-appointed experts as one technique that judges may use when faced with especially difficult expert testimony.[8] Court-appointed experts have traditionally been used to offer testimony at trial. Recently, court-appointed experts have also been used in a variety of pretrial procedures, such as educating judges concerning the fundamental concepts on which the experts differ and offering assessments of the methodology on which the parties' experts are basing their opinions. The paper on court-appointed experts considers the issues involved in using court-appointed experts and offers suggestions for their selection, instruction, and compensation.

Special masters may be appropriate in extraordinary cases in which the demanding nature of the scientific issues is combined with the need for special skills in fact finding. Special masters may also be appointed to conduct settlement negotiations in cases with difficult scientific testimony, or to manage the pretrial stages of cases in which problems of expert testimony may be common. The paper on special masters draws on the lessons learned in other forms of complex litigation to provide models for the use of special masters in cases involving complex scientific evidence.

8. *Id.* at 2798.

This manual represents an initial attempt to develop information that will aid judges in dealing with complex scientific and technical evidence. This is a difficult topic, and thoughtful observers may differ on the issues that should be addressed in such a manual. We need to learn more about the nature of problems that arise with such evidence and are eager to receive comments and suggestions for improvements in this manual. We also invite suggestions for additional topics that should be addressed. With such assistance we will be able to tailor future editions of the manual to fit the evolving needs of the judiciary.

This manual is intended to complement other manuals prepared by the Center: generic case management techniques are dealt with at length in the *Manual for Litigation Management and Cost and Delay Reduction*,[9] and suggestions for managing litigation that is procedurally complex are found in the *Manual for Complex Litigation*.[10] This manual focuses on the management of expert evidence. The management needs of cases differ; management is not an end in itself but should be designed to bring about the just resolution of cases. Although case management is a judicial responsibility, it is also the responsibility of attorneys, not only to serve their clients well but also to preserve the integrity and credibility of the justice system. This manual is intended to assist all parties to the litigation, attorneys as well as judges.

William W Schwarzer

9. Manual for Litigation Management and Cost and Delay Reduction (Federal Judicial Center 1992).
10. Manual for Complex Litigation, Third (forthcoming 1995).

Management of Expert Evidence

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Contents

I. Introduction

The purpose of this manual, and this paper in particular, is to assist judges in implementing effective management of expert evidence involving scientific issues. Depending on the nature, novelty, and complexity of such evidence, particular management measures and techniques may be necessary and appropriate. This paper deals with those kinds of measures and techniques. It does not deal with generic case management, or with case management of complex litigation generally, which will also often be necessary in such cases. For example, mass tort cases, which frequently involve scientific evidence, will also require the application of techniques to manage multiparty litigation. Those subjects are beyond the scope of this manual; they are covered in the Federal Judicial Center's *Manual for Litigation Management and Cost and Delay Reduction*, published in 1992, and the *Manual for Complex Litigation*, the third edition of which will appear in 1995.

II. The Initial Conference

A. Assessing the Case

The court's first contact with a case will normally be at the initial Rule 16 conference. Note, however, that the attorneys should have previously met, as required by Federal Rule of Civil Procedure 26(f), "to discuss the nature and basis of their claims and defenses . . . and to develop a proposed discovery plan . . . and [to submit] to the court . . . a written report outlining the plan."[1] Compliance with this "meet and confer" requirement is essential to effective case management. The report, prepared and submitted by the attorneys, together with the pleadings and other available materials, should give the judge useful insight into the case, including information about scientific issues and the likelihood of expert evidence, although this will not invariably be true. In addition, as a result of their conference, the attorneys should be reasonably well informed about the case and should be prepared for the initial conference. Expert testimony, and possible limitations or restrictions on its use, is specifically made a subject for the initial conference, as well as subsequent conferences by Federal Rule of Civil Procedure 16(c)(4).[2] Thus the judge should raise the subject of prospective expert evidence at the conference and begin to explore the issues bearing on it.

The range of subject matter addressed by expert evidence is virtually limitless. It covers the spectrum of the various sciences (both so-called hard and soft sciences), and it extends to other areas of technical or specialized knowledge in which people who have acquired special knowledge, skill, experience, training, or education may be able to give testimony that would assist in the resolution of disputed questions of fact.[3] Surveys indicate that expert testimony comes predominantly from physicians in various specialties, followed by economists, both of which are common in personal injury cases.[4] Engineers also frequently testify,

1. *See* Fed. R. Civ. P. App. of Forms, Form 35 (Report of Parties' Planning Meeting).

2. The Advisory Committee Notes state that the rule is intended to "clarify that in advance of trial the court may address the need for, and possible limitations on, the use of expert testimony." Fed. R. Civ. P. 16(c)(4) advisory committee's notes.

3. *See* Fed. R. Evid. 702.

4. *See* Molly Treadway Johnson & Joe S. Cecil, Problems of Expert Testimony in Federal Civil Trials (Federal Judicial Center forthcoming 1995). For a breakdown of experts appearing in state courts, see Anthony