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ANTONIN SCALIA LAW SCHOOL
George Mason University

Scientific Methodology and the Evaluation of Scientific Evidence and Expert Testimony

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Scientific Methodology

- All "experts," as understood in the litigation context, must be committed to following scientific methodology if they are to be pass through the gates as experts—even if not all expert testimony is about "science" per se.
- This leaves all experts open to objective evaluation and critique of methods, processes, and principles separate and apart from subjective disagreement with substantive conclusions.

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What is Science?

- A body of collected and ever-advancing knowledge that is empirical, social, practical, and agnostic.
  - "The systematic study of the natural world and its physical and biological processes, through observation, identification, description, experimental investigation, and theoretical explanations."

science. *Oxford Reference.*
Retrieved 14 Oct. 2024, from
https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100447569

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What is the Scientific Method?

- "*scientific method* – principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses"
  https://www.merriam-webster.com/dictionary/scientific%20method

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What is the Scientific Method?

"Scientific method is the logic by which the observations are made. Well designed methods permit observations that lead to valid, useful, informative answers to the questions that had been framed by the researcher. For scientists, the key word in the phrase "scientific method" is method. Methodology-the logic of research design, measures, and procedures-is the engine that generates knowledge that is scientific. While for lawyers and judges credibility is the key to figuring out which witnesses are speaking truth and which are not, for scientists the way to figure out which one of several contradictory studies is most likely correct is to scrutinize the methodology."

MICHAEL J. SAKS, *Chapter 4: Scientific Method: The Logic of Drawing Inferences From Empirical Evidence, in* DAVID FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE, 313, 313-353 (2002).

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What Science is Not

"Some people or groups who call themselves scientists do not use the scientific method. That is, their beliefs have not been subjected to systematic empirical testing. Their own and their field's beliefs are based on casual observation, or intuition, or faith, or the authority of past generations of members of their field exercising their intuition. Masquerading as science, such claims are likely to be defended by statements that the truth of the assertion rests on "my many years of experience," or "generations of study by my field." Were the findings based on evidence produced by the scientific method, the expert should be able to present those studies to any audience, including a court, along with the methodology and the results of the studies."

MICHAEL J. SAKS, *Chapter 4: Scientific Method: The Logic of Drawing Inferences From Empirical Evidence, in* DAVID FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE, 313, 313-353 (2002).

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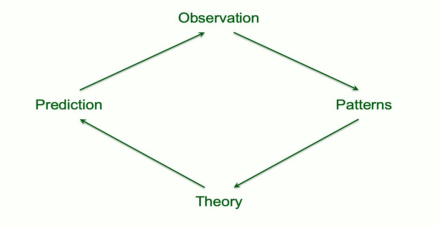
What is the Scientific Method?



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Hypothesis Testing

- Positing predictions based on theories (smoking is dangerous to health) and showing that they cannot be rejected;

  or more usually and more technically

- Proposing a null hypothesis (smoking is not dangerous) and seeking to find statistically significant results to reject the null hypothesis; failing to do so means you cannot reject the null (so, for example, you cannot say that smoking is dangerous if it does not show a statistically significant effect on health negating the null hypothesis)

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Hypothesis Testing

- Requires controlling against other potential variables
- Allows to test for levels of confidence or power in the result
- Allows one to talk about probabilities
- There are different methods of such testing
- But it never allows you to say you have "proven" X

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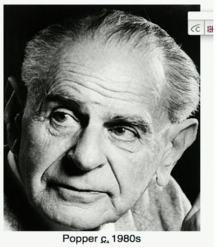
No Such Thing As Scientific Proof

Sir Karl Raimund Popper was generally regarded as one of the 20th century's greatest philosophers of science. . . . "A theory in the empirical sciences can never be proven, but it can be falsified, meaning that it can and should be scrutinized by empirical testing."



Popper c. 1980s

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Implications for Burden Placement, and Possible Jury Concern

Defendant cannot "prove" a negative. Cannot prove that something did not cause harm – outside impossibility issues such as proving they never used a product, but that is a different issue.

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Science is Fundamentally Different from Law

- View of precedent – scientists seek to change precedent as new research is done and discoveries made
- Scientists study groups and populations and then compare them
- Scientists can draw inferences from research about general causation, while courts are interested in general causation but must get to specific causation – expectations are different between scientists and courts.
- Mismatch can get confused in the courtroom – scientists outside the courtroom do not reason from generalized causation to specific causation; nor do they know how to do this! They talk only about probabilities.

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Protecting the Roles of the Jury: Competing Considerations

- There is a fundamental struggle over the allocation of responsibility between judges and adversarial process as vetting devices and between the judges and jury as deciders on reliability.
- As a matter of policy, prudence, and constitutional law, we rely on and respect juries.
- We worry about rules that remove decisions from the jury.

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Protecting the Roles of the Jury: Competing Considerations

- And this is undoubtedly a big tension directly created by Daubert and Rule 702; and it may explain some hesitation by judges to embrace robust gatekeeping.
- Comparative competencies issue
- Judges also don't always see why they—layman, non-experts themselves just like jurors—are any better suited to vet scientific evidence than the lay jury.
- These concerns motivated pre-2011 North Carolina law.

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Striking the Balance in North Carolina

"A rule governing the admission of expert testimony necessarily strikes a balance between competing concerns since the testimony "can be both powerful and quite misleading" to a jury "because of the difficulty in evaluating it." ***Daubert***, 509 U.S. at 595, 113 S.Ct. 2786 (quoting Jack B. Weinstein, *Rule 702 of the Federal Rules of Evidence is Sound; It Should Not Be Amended*, 138 F.R.D. 631, 632 (1991)). The interpretation we gave to Rule 702(a) in *Howerton* struck one such balance; the ***Daubert*** standard, now incorporated into North Carolina law, strikes another."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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Why is Expert Testimony Different?

- Jurors may "overweight" expert testimony
- Complexity of scientific information may confuse juries
- Lack of a gatekeeping function will take encourage introducing material that takes advantage of juror ignorance or emotion.
- Protecting due process rights of parties.
- And more, including perhaps most importantly:
  - Expert witnesses are fundamentally different from fact witnesses

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Expert Witnesses are Different From Fact Witnesses

- Attorneys must take fact witnesses as they find them; they're dealing with a closed set.
- Unlike ordinary fact witnesses, attorneys shop for expert witnesses who (a) are good at testifying; and (b) will develop expert testimony consistent with that side's theory of the case.

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Why is Expert Testimony Different?

- When looking for an expert, an attorney isn't looking for the "best" expert in the field or a group of experts to present the consensus of the scientific community.
- The attorney is looking for an expert that will support the attorney's theory of the case.
- And the jury would not be using the expert to find "truth" in causation or anything else. Nor should the jurors get confused that the experts are providing "proof." Causation is necessarily speculative.

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Daubert Trilogy, as explained by North Carolina Supreme Court

"In 1993, the United States Supreme Court interpreted Rule 702 of the Federal Rules of Evidence in ***Daubert***. See 509 U.S. at 588–98, 113 S.Ct. 2786. The Court held that Rule 702 required federal district courts to determine, before they admitted expert testimony, "that any and all scientific testimony ***885** or evidence admitted is not only relevant, but reliable." *Id.* at 589, 113 S.Ct. 2786. This determination entailed "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." *Id.* at 592–93, 113 S.Ct. 2786. According to the Court, Rule 702 gave federal district courts a "gatekeeping role." *Id.* at 597, 113 S.Ct. 2786. The Court further clarified the ***Daubert*** standard in *General Electric Co. v. Joiner*, 522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997), and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999). The Court indicated that these three cases established "exacting standards of reliability" for the admission of expert testimony. *Weisgram v. Marley Co.*, 528 U.S. 440, 455, 120 S.Ct. 1011, 145 L.Ed.2d 958 (2000) "

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if the proponent demonstrates to the court that it is more likely than not that:

a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
b) the testimony is based on sufficient facts or data;
c) the testimony is the product of reliable principles and methods; and
d) the ~~expert has reliably applied~~ expert's opinion reflects a reliable application of the principles and methods to the facts of the case.

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North Carolina Rule 702

Rule 702. Testimony by experts.

(a) If scientific, technical or other specialized 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 thereto in the form of an opinion, or otherwise, if all of the following apply:

(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.

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North Carolina Rule 702
State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

"We hold that the 2011 amendment adopts the federal standard for the admission of expert witness testimony articulated in the ***Daubert*** line of cases. The General Assembly amended North Carolina's rule in 2011 in virtually the same way that the corresponding federal rule was amended in 2000. It follows that the meaning of North Carolina's Rule 702(a) now mirrors that of the amended federal rule."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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Rule 702

DON'T SAY ~~DAUBERT~~

- Rule supersedes caselaw
- North Carolina recognized the same in its rule.

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North Carolina Rule 702

- **After explaining the importance of the shift from a more liberal standard with concerns about judicial "gatekeeping" . . . The North Carolina Supreme Court held:**

"By adopting virtually the same language from the federal rule into the North Carolina rule, the General Assembly thus adopted the meaning of the federal rule as well. In other words, North Carolina's Rule 702(a) now incorporates the standard from the ***Daubert*** line of cases. Whatever this Court's reservations about the ***Daubert*** standard were, see *Howerton*, 358 N.C. at 464–69, 597 S.E.2d at 690–93, the General Assembly has made it clear that North Carolina is now a ***Daubert*** state. . . . the federal rule's amended language codified not only ***Daubert***, but also *Joiner* and *Kumho*. To determine the proper application of North Carolina's Rule 702(a), then, we must look to the text of the rule, to all three of these United States Supreme Court cases, and also to our existing precedents, as long as those precedents do not conflict with the rule's amended text or with ***Daubert***, *Joiner*, or *Kumho*.

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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Rule 702. Testimony by Expert Witnesses

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if the proponent demonstrates to the court that it is more likely than not that:

(a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert's opinion reflects a reliable application of the principles and methods to the facts of the case.

Notes

(Pub. L. 93–595, §1, Jan. 2, 1975, 88 Stat. 1937; Apr. 17, 2000, eff. Dec. 1, 2000; Apr. 26, 2011, eff. Dec. 1, 2011.)

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North Carolina Rule 702

- Relevance Inquiry
- Qualifications Inquiry
  - Sub-inquiry is one of Nexus – is the expert actually limiting their testimony to matters within the field; drift is common!

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Qualifications Inquiry – A Necessary and Subsumed Sub-Inquiry Into Fit and Nexus

"Not all knowledge asserted by people who are commonly thought of as scientists is the product of the scientific method. It will help to think of science as a verb, not a noun. Science is what one does to build knowledge, not what someone is."

MICHAEL J. SAKS, *Chapter 4: Scientific Method: The Logic of Drawing Inferences From Empirical Evidence, in* DAVID FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE, 313, 316(2002).

"Sometimes there is a zone of genuine scientific knowledge possessed by a field, but some or many of its members step outside of that zone and make assertions that exceed their field's empirically tested knowledge or they are answering questions that are based in part on well tested knowledge and in part on speculation."

Id. at 317

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North Carolina Rule 702

- Reliability Inquiry
  - "The primary focus of the inquiry is on the reliability of the witness's principles and methodology, *Joiner*, 522 U.S. at 146, 118 S.Ct. 512, "not on the conclusions that they generate," ***Daubert***, 509 U.S. at 595, 113 S.Ct. 2786. However, "conclusions and methodology are not entirely distinct from one another," and when a trial court "conclude[s] that there is simply too great an analytical gap between the data and the opinion proffered," the court is not required "to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *Joiner*, 522 U.S. at 146, 118 S.Ct. 512."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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North Carolina Rule 702's Reliability Test

"In the context of scientific testimony, ***Daubert*** articulated five factors from a nonexhaustive list that can have a bearing on reliability: (1) "whether a theory or technique ... can be (and has been) tested"; (2) "whether the theory or technique has been subjected to peer review ***891** and publication"; (3) the theory or technique's "known or potential rate of error"; (4) "the existence and maintenance of standards controlling the technique's operation"; and (5) whether the theory or technique has achieved "general acceptance" in its field. ***Daubert***, 509 U.S. at 593–94, 113 S.Ct. 2786.

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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North Carolina Rule 702's Reliability Test

"When a trial court considers testimony based on "technical or other specialized knowledge," N.C. R. Evid. 702(a), it should likewise focus on the reliability of that testimony, *Kumho*, 526 U.S. at 147–49, 119 S.Ct. 1167. The trial court should consider the factors articulated in ***Daubert*** when "they are reasonable measures of the reliability of expert testimony." *Id.* at 152, 119 S.Ct. 1167. Those factors are part of a "flexible" inquiry, ***Daubert***, 509 U.S. at 594, 113 S.Ct. 2786, so they do not form "a definitive ****10** checklist or test," *id.* at 593, 113 S.Ct. 2786. And the trial court is free to consider other factors that may help assess reliability given "the nature of the issue, the expert's particular expertise, and the subject of his testimony." *Kumho*, 526 U.S. at 150, 119 S.Ct. 1167."

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North Carolina Rule 702

"The federal courts have articulated additional reliability factors that may be helpful in certain cases, including:

(1) Whether experts are proposing to testify about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying.
(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 professional work outside his paid litigation consulting.
(5) Whether the field of expertise claimed by the expert is known to reach reliable results for the type of opinion the expert would give.

Fed. R. Evid. 702 advisory committee's note to 2000 amendment (citations and quotation marks omitted)."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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North Carolina Rule 702

"In some cases, one or more of the factors that we listed in *Howerton* may be useful as well. *See Howerton*, 358 N.C. at 460, 597 S.E.2d at 687 (listing four factors: use of established techniques, expert's professional background in the field, use of visual aids to help the jury evaluate the expert's opinions, and independent research conducted by the expert)."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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North Carolina Rule 702 – Judicial Role and Standard: Preponderance of the Evidence

"Whether expert witness testimony is admissible under Rule 702(a) is a preliminary question that a trial judge decides pursuant to Rule 104(a). N.C.G.S. § 8C–1, Rule 104(a) (2015); . . . In answering this preliminary question, the trial judge "is not bound by the rules of evidence except those with respect to privileges." N.C. R. Evid. 104(a). To the extent that factual findings are necessary to answer this question, the trial judge acts as the trier of fact. N.C. R. Evid. 104(a) commentary. The court must find these facts by the greater weight of the evidence. *See* ***Daubert***, 509 U.S. at 592 n. 10, 113 S.Ct. 2786 ("These matters should be established by a preponderance of proof." ****11** (citing *Bourjaily v. United States*, 483 U.S. 171, 175–76, 107 S.Ct. 2775, 97 L.Ed.2d 144 (1987) (using the term "preponderance of the evidence" synonymously with "preponderance of proof"))); *Cincinnati Butchers Supply Co. v. Conoly*, 204 N.C. 677, 679, 169 S.E. 415, 416 (1933) (equating "preponderance of the evidence" with "greater weight of the evidence"). ***893** As with other findings of fact, these findings will be binding on appeal unless there is no evidence to support them. *State v. King*, 366 N.C. 68, 75, 733 S.E.2d 535, 540 (2012)."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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North Carolina Rule 702 – Judicial Role and Standard: Preponderance of the Evidence

"The trial court then concludes, based on these findings, whether the proffered expert testimony meets Rule 702(a)'s requirements of qualification, relevance, and reliability. This ruling "will not be reversed on appeal absent a showing of abuse of discretion." *Howerton*, 358 N.C. at 458, 597 S.E.2d at 686. And "[a] trial court may be reversed for abuse of discretion only upon a showing that its ruling was manifestly unsupported by reason and could not have been the result of a reasoned decision." *State v. Riddick*, 315 N.C. 749, 756, 340 S.E.2d 55, 59 (1986). The standard of review remains the same whether the trial court has admitted or excluded the testimony—even when the exclusion of expert testimony results in summary judgment and thereby becomes "outcome determinative." *Joiner*, 522 U.S. at 142–43, 118 S.Ct. 512."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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History of Courts Ignoring Rule 702

- Bernstein & Lasker 2015 *William & Mary Law Review* article
- Errors in application
- Continued view that the standard was judge made
- Presumptions in favoring of admissibility

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History of Courts Ignoring Rule 702

- Failure to adopt preponderance of the evidence and gatekeeping role
- Citations to outdated precedents as the rule or as supplementing Daubert

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History of Courts Ignoring Rule 702

- Why was this happening?
  - This is hard to get right!
  - This is hard – resource intensive;
  - Sometimes ignorance of the law or of the full nature of the change;
  - sometimes defiance of it;
  - SCOTUS didn't explain the rationale for the rule very well, so tough to understand and not great for persuasion either;
  - sometimes sloppy copying?

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Rule 702 Amendments

- "The Committee concluded that emphasizing the preponderance standard in Rule 702 specifically was made necessary by the courts that have failed to apply correctly the reliability requirements of that rule."
- "The amendment clarifies that the preponderance standard applies to the three reliability-based requirements added in 2000—requirements that many courts have incorrectly determined to be governed by the more permissive Rule 104(b) standard. But it remains the case that other admissibility requirements in the rule (such as that the expert must be qualified and the expert's testimony must help the trier of fact) are governed by the Rule 104(a) standard as well."
  - Report of the Advisory Committee on Evidence Rules, May 15, 2022.

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Rule 702 Amendments

- "emphasizing that incorporating the preponderance standard into the text of Rule 702 was made necessary by the decisions that have failed to apply it to the reliability requirements of Rule 702."
- "Rule 702(d) has also been amended to emphasize that each expert opinion must stay within the bounds of what can be concluded from a reliable application of the expert's basis and methodology. Judicial gatekeeping is essential because just as jurors may be unable, due to lack of specialized knowledge, to evaluate meaningfully the reliability of scientific and other methods underlying expert opinion, jurors may also lack the specialized knowledge to determine whether the conclusions of an expert go beyond what the expert's basis and methodology may reliably support."
  - Report of the Advisory Committee on Evidence Rules, May 15, 2022.

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Rule 702 Amendments (Approved 2022 and made effective December 1, 2023)

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if the proponent demonstrates to the court that it is more likely than not that:

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Notes

(Pub. L. 93–595, §1, Jan. 2, 1975, 88 Stat. 1937; Apr. 17, 2000, eff. Dec. 1, 2000; Apr. 26, 2011, eff. Dec. 1, 2011.)

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Tools Available to Judges to Help Them Better Evaluate or Understand Science in the Courtroom

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Wide Latitude with Procedure to Determine Reliability

"Rule 702(a), as amended in 2011, does not mandate particular "procedural requirements for exercising the trial court's gatekeeping function over expert testimony." Fed. R. Evid. 702 advisory committee's note to 2000 amendment. The trial court has the discretion to determine "whether or when special briefing or other proceedings are needed to investigate reliability." *Kumho*, 526 U.S. at 152, 119 S.Ct. 1167. A trial court may elect to order submission of affidavits, hear voir dire testimony, or conduct an *in limine* hearing. *See* Fed. R. Evid. 702 advisory committee's note to 2000 amendment. More complex or novel areas of expertise may require one or more of these procedures. *See Kumho*, 526 U.S. at 152, 119 S.Ct. 1167. In simpler cases, however, the area of testimony may be sufficiently common or easily understood that the testimony's foundation can be laid with a few questions in the presence of the jury. *See id.* The court should use a procedure that, given the circumstances of the case, will "secure fairness in administration, elimination of unjustifiable expense and delay, and promotion of growth and development of the law of evidence to the end that the truth may be ascertained and proceedings justly determined." N.C.G.S. § 8C–1, Rule 102(a) (2015)."

State v. McGrady, 368 N.C. 880, 787 S.E.2d 1 (2016)

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Tools Available to Judges to Help Them Better Evaluate or Understand Science in the Courtroom

- NAS/FJC Reference Manual on Scientific Evidence
- Science Tutorials, aka Science Days
- Independent Panels under FRE 706 or state equivalent
- Court appointed experts under FRE 706 or state equivalents

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Tools Available to Judges to Help Them Better Evaluate or Understand Science in the Courtroom

- Actual 702 Hearings, beyond the papers; bringing in the experts
- Mini-trials
- Special masters under FRCP 53 or state equivalents
- Technical Advisers, aka Specialized Clerks (even Breyer suggested it in *Kumho* concurrence)

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