

THE NATIONAL JUDICIAL COLLEGE &  
JUSTICE SPEAKERS INSTITUTE, LLC

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# SCIENCE BENCH BOOK FOR JUDGES

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2D ED.



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THE NATIONAL  
JUDICIAL COLLEGE



**Justice Speakers Institute**  
PROMOTING JUSTICE WORLDWIDE

## *In Memoriam*



The National Judicial College and the Justice Speakers Institute wish to recognize and honor **Judge Peggy Fulton Hora**. On October 31, 2020, Judge Hora passed away. This Judicial Science Bench Book was one of the culminations of her life's work to educate the judiciary.

Judge Hora was the President and one of the Founders of the Justice Speakers Institute, LLC. She was a pioneer in the justice system, a global leader in the drug treatment court field, and a champion for therapeutic jurisprudence.

For over 25 years Judge Hora was on the faculty of the National Judicial College (NJC) and she was the recipient of the 2017 V. Robert Payant Award for Teaching Excellence presented by the Faculty Council of the NJC.

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### SCIENCE BENCH BOOK FOR JUDGES

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Finally, we thank several members of NJC's staff who supported the project, including Joy Lyngar, provost, and Sheena Britschgi Evans, technology manager. In particular, we'd like to acknowledge the work of recently retired NJC Course Administrator, Crystal Noel, who provided administrative support for the project, and kept us organized.

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## EDITING & DESIGN

**Hon. Peggy Hora (Ret.)**

JSI President  
Walnut Creek, California

**Hon. Brian MacKenzie (Ret.)**

JSI Chief Financial Officer  
Novi, Michigan

**Theodore Stalcup, Esq.**

Attorney  
Tomales, California

**David Wallace, Esq.**

JSI Vice President  
Harbor Beach, Michigan

## CONTRIBUTING AUTHORS

**Brian Abbott**

Assistant Director, Hayden Planetarium  
New York, New York

**Hon. Benes Z. Aldana (Ret.)**

President & CEO, National Judicial College  
Reno, Nevada

**Hon. Kevin Burke (Ret.)**

Judge, District Court  
Hennepin County, Minnesota

**Hon. Louis B. Butler, Jr. (Ret.)**

Justice, Supreme Court  
Milwaukee, Wisconsin

**Eryn Blagg**

Doctoral Student  
Iowa State University

**Alicia Carriquiry, Ph.D.**

Distinguished Professor of Statistics  
Iowa State University

**Hon. Ming Chin (Ret.)**

Associate Justice, Supreme Court  
San Francisco, California

**Christine Funk, J.D.**

Attorney  
St. Paul, Minnesota

**Hon. Veronica Alicea-Galvan**

Judge, Superior Court  
King County, Washington

**Hon. Cindy Lederman (Ret.)**

Judge, Dependency Court  
Dade County, Florida

**Hon. Brian MacKenzie (Ret.)**

Judge, District Court  
Novi, Michigan

**Hon. Bridget Mary McCormack**

Chief Justice, Supreme Court  
Lansing, Michigan

**Hon. Joseph J. Maltese, J.D., Ph.D.**

Associate Justice, Supreme Court  
Appellate Division, 2<sup>nd</sup> Department  
Staten Island, New York

**Marc Picker, Esq.**

Alternate Public Defender  
Reno, Washoe County, Nevada

**Hon. Samuel A. Thumma**

Chief Judge, Division One  
Court of Appeals, Arizona



## SCIENCE BENCH BOOK FOR JUDGES

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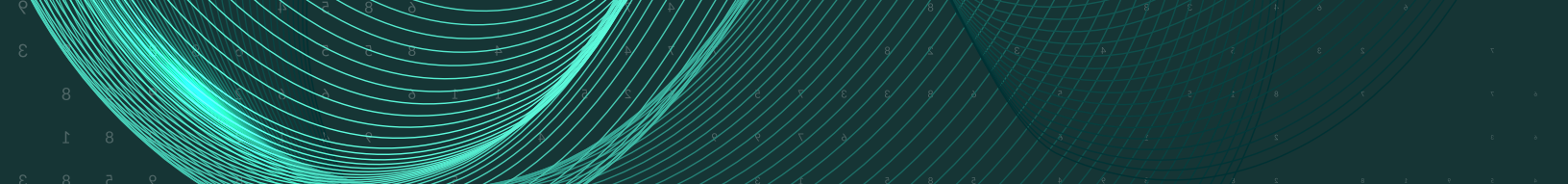
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# 1. INTRODUCTION

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**HON. BENES ALDANA (RET.)**

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## 1.1 WHY THIS BENCH BOOK?

The National Judicial College and the Justice Speakers Institute, LLC developed this bench book with support from the State Justice Institute to help judges determine the admissibility of evidence based on sound forensic science. The fact is, few judges were scientists in a previous career. The scientific method is not second nature to most, and few subscribe to scientific journals. In a worst-case scenario, a judge could admit so-called “scientific testimony” even after the scientific community had discredited it.

This first-of-its kind book for state court judges is a practical guide to the key types of scientific evidence judges are likely to encounter on the bench. It is the work of expert judges and practitioners. All judges, new or experienced, will find it helpful when considering complex scientific evidence.

With the current attack on science and mistrust in certain scientific theories, it is critical that judges have a solid foundation in science and the tools to evaluate emerging scientific theories and technologies.

As the evidential gatekeepers, judges decide which science-related evidence is admissible. The trier of fact, whether the judge or a jury, must also decide what weight to give to the evidence.

*This first-of-its kind book for state court judges is a practical guide to the key types of scientific evidence judges are likely to encounter on the bench.*

To do this well requires knowledge of the reliability of certain types of purported scientific evidence. For example, bite-mark evidence is the process by which forensic odontologists attempt to match teeth marks found at crime scenes with the dental impressions of a suspect. Although bite-mark evidence is routinely admitted by courts in the United States, science has not validated the theory that a person’s dentition is unique like DNA.



Judges have also routinely admitted voiceprint identification, even though a National Academy of Sciences committee found no empirical evidence that voiceprint examiners can dependably identify the source of a recorded voice.

The evidence rules and case law make admissibility of evidence contingent upon validation. Yet some judges do not understand that different evidentiary standards exist for the admissibility of scientific evidence. They also may not know the standard that applies in their state.

This inaugural edition is designed to provide judges not only a grounding in science, but also guidance in what distinguishes scientific evidence from technical evidence. The sections are organized for easy reference during pre-trial, trial and post-trial proceedings (including post-sentencing supervision), and the information is applicable to both civil and criminal proceedings.

We hope you find this bench book useful, and we invite your comments and suggestions on how to make the next edition better still.

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An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. The background is dark, and the mesh is composed of numerous thin lines. Scattered throughout the mesh are various numbers in a light teal color, including 1, 2, 3, 4, 5, 6, 7, 8, and 9, some appearing in larger sizes than others.

# 2. WHAT IS SCIENCE?

Sections 2.1 - 2.5

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**BRIAN ABBOTT**

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## 2.1 INTRODUCTION

Humans are innately curious, so it seems natural to pursue knowledge that improves our daily existence and advances the species. Each breakthrough, on balance, serves to improve subsequent generations' lives and livelihoods. The result is a more stable, democratic society that yields dividends from the competition, cooperation, and achievements that are rooted in the scientific process.

The scientific process is often misunderstood by the layperson and misrepresented in the media. Science cannot often be distilled down to sound bites that media voraciously consume. The process is far subtler, and the cost of concealing the evolution of ideas and the thought processes of scientists is a general lack of scientific literacy. This results in statements like, "It's only a theory," downplaying the strongest expression of reality that we have.

A fundamental tenet of science is that facts and truth do not exist. Scientists look at evidence, perform experiments, and analyze data to understand how the universe works. In the purest sense, we cannot definitively "close the book" on anything and say it is a known fact. All we can do is find an equation that works and continue to test it under varying conditions.

*The media's statement such as, "It's only a theory," downplays the strongest expression of reality that we have.*

The classic example of this is the theory of gravitation. Since antiquity, philosophers like Aristotle, the scientists of their time, conjectured that motion did not occur without cause. Centuries passed, when, in 1687, Isaac Newton brilliantly quantified this notion in an equation. Subsequent

tests of this theory supported Newton's hypotheses, the most profound of which was the deduction of the existence of a planet beyond Uranus (based on the fact that Uranus's motion did not agree with Newton's theory). In 1846, scientists used Uranus's anomalous motion and Newton's theory to accurately predict where the planet causing this motion should be, and subsequently discovered Neptune a month later to great accolade.

## 2. WHAT IS SCIENCE?

However, over time, discrepancies began to appear, including the unexplained drag on Mercury's orbital motion. By the Twentieth Century, it was evident that the theory needed more work. The general theory of relativity, developed by Einstein and published in 1915, was the remedy. General relativity describes the warping of space and time due to gravity, and this small effect was the necessary addition that shored up Newton's theory of gravity. Is today's theory of gravity in its final form? Do we now know everything about gravity? For scientists, it's not possible to say. The theory will continue to be tested and if discrepancies emerge, they will be investigated.

*A fundamental tenet of science is that facts and truth do not exist. Scientists look at evidence, perform experiments, and analyze data to understand how the universe works.*

## 2.2 THE SCIENTIFIC METHOD

This, in a nutshell, tells the never-ending story of science. But let's examine each step with more precision. Scientists have many tools at their disposal to investigate

*All scientific disciplines rest on two primary axioms: scientists must publish their results, and credibility is lent only when work is judged by one's peers.*

the world. They rely on experimentation and their own intellectual set of tools to investigate the unfamiliar. The fate of the scientist is to exist in a continual state of ignorance—their work lies just beyond the forefront of knowledge. A scientist must be comfortable steeped in the unknown, where creativity, confidence, and resolve decode problems and move the intellectual vanguard forward.

Data are collected via experiment, then analyzed for trends and consistency. Astrophysics, my field, is predominantly divided into two categories:

observational (or, experimental) and theoretical. The observational astronomer gathers data from telescopes, be they on the ground or in space, and returns with data perhaps in the form of an image, a measure of brightness, or a spectrum of an object. After analyzing these data, conclusions may be drawn, and the project is written up for publication.

The theoretical astrophysicist writes computer codes to explain the universe using only the laws of physics. The job of the theoretician is to reproduce what one observes in nature. If the output of one's code matches what we observe, then there's a good chance that code reflects what's actually happening. The theoretician relies on the language of science—mathematics—to explain phenomena. This is not so dissimilar from medical, biological, or any other form of research, that also have experimental and theoretical undertakings.

All scientific disciplines rest on two primary axioms: scientists must publish their results, and credibility is lent only when work is judged by one's peers. These two aspects of science ensure that knowledge advances and, more importantly, that the process is self-regulated. The notion of peer review is incredibly important and permeates all aspects of science, from the initial proposal, to the published results.



## 2.3 THE PEER REVIEW PROCESS

Peer review starts in the proposal process, where scientists compete for particular grants in their field. Each grant will have a committee of scientists in the related subfield who review proposals and choose those they deem most likely to succeed.

*While the peer-review process is a strong gateway to accepted science, it is not absolutely infallible—a result must be reproducible by others.*

Through this process, proposals with unfounded or specious reasoning, it is assumed, are culled and will be declined. This initial “weeding out” establishes a level of competency among those projects that are funded.

Peer review enters into the process again at the end of the project. Upon submission to a scientific journal, each paper will be assigned to another scientist in the field who may choose to remain anonymous and shall review the work and judge it for competence, worthiness, and its scientific rigor.

This is the final opportunity to judge the work before it is added to the annals, and to confirm that it will indeed further our understanding of the world.

While the peer-review process is a strong gateway to accepted science, it is not absolutely infallible—a result must be reproducible by others. Once a paper is published, others will try to reproduce its results, so they, too, can build upon its advances.

If others cannot reproduce the work, it will be called into question and discussion will ensue. These discussions can take place face-to-face, or in the journals themselves, where papers may appear countering its results.



## 2.4 THE MYTH OF SCIENTIFIC OBJECTIVITY

These discussions are not always free of bias, including bias for one's own work, or even politically motivated bias. However, it is the duty of the scientist to be hyper-aware of these biases and to doggedly question them. Of course, it is impossible to completely remove bias, but it is possible to operate ethically in the process. As it is in life, part of understanding a colleague's motivation is to understand their potential biases. Scientists often develop emotional attachments to their work—it can be difficult to abandon an idea. Regardless of bias, the strongest intellectual argument, based on accepted scientific hypotheses, will always prevail, but the road to that conclusion may be fraught with scholarly cul-de-sacs.

All of these biases and beliefs play into the process of weighing data, a critical aspect of science. Placing weight on a result is the process of assigning a probability to an outcome. Everything in the universe can be expressed in probabilities. While extremely unlikely, it is plausible for all the air molecules to move to one side of a room; however, one would not place too much weight on that outcome. The weight we apply to a scientific notion is proportional to the strength of the foundation that the notion rests upon. While it is judicious to question everything, scientists push forward based on established scientific theories. Those established theories resemble the closest thing we have to fact and are used to build new theories.

*The highest form of expertise is achieved when one remains immersed in their field and continues to publish in peer-reviewed journals.*

Because the forefront of science is rarely encountered in court, much of the science mentioned there shall be considered established, and therefore carries significant weight. These encounters often flow through experts, who attest to scientific relevance and authenticity. Expertise, however, hinges on one's involvement in science and unbiased interest. Involvement begins with the proper training, but, more importantly, it is maintained by remaining active in science and publishing peer-reviewed papers. Terminating one's involvement after training diminishes one's expertise. If someone receives a doctorate and subsequently works out of their



## 2. WHAT IS SCIENCE?

field, their knowledge will wither, and their expertise will erode over the years. The highest form of expertise is achieved when one remains immersed in their field and continues to publish in peer-reviewed journals.

The evolution of ideas alludes to the balance of cooperation and competition within the scientific community. Cooperation is essential now more than at any time in history, with dozen-, hundred- or even thousand-member collaborations appearing as authors on one paper. However, competition drives innovation. Intellectual competition inspires one to be the first to discover something new. When balanced, cooperation and competition ensure the steady flow of ideas and a healthy rate of growth, pushing the frontier of understanding perpetually further.

## 2.5 SCIENCE IS ACQUIRING KNOWLEDGE

Science is the process of acquiring knowledge. Using empirical methods, with a healthy dose of skepticism, leads to the formulation of hypotheses and their refinement via experimental testing. Cogent hypotheses will yield predictions that may be tested, altered, or expanded, thereby strengthening their validity. With an abundance of experimental support, a hypothesis may become a general theory—a

*With an abundance of experimental support, a hypothesis may become a general theory—a much stronger statement of reality.*

much stronger statement of reality. While our current theories may not be perfect, they are the strongest statements we have for expressing how the universe works.

Science's self-regulated nature ensures that ideas maintain a standard which rest upon the foundation of thought and theory that precede them. This constant evolution enables scientists to credibly weigh evidence and assign probabilities to particular scenarios in the real world. Peer

review helps reduce potential biases, and promotes a self-corrective process, where rejection of ideas also contributes toward understanding. Those who remain active in science and publish in peer-reviewed journals, will inherently be experts in their field of study.

Fact and truth are words that we conveniently apply to our notions of how the universe operates. We use these words because we place our faith in science and its ability to describe and predict the physical world accurately. What we forget is that we live in a world that cares not for our theorems, and, at times, reminds us just how ignorant we remain.



An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. Scattered throughout the background are small, light-colored numbers (0-9) in various orientations, giving it a digital or data-driven appearance.

# 3. SCIENTIFIC EVIDENCE

Sections 3.1 - 3.9

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**HON. BRIDGET MARY McCORMACK**

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### 3.1 INTRODUCTION

The goal of a trial, of course, is to find the truth about disputed questions. It is not unlike science which aims to find the truth about questions regarding the physical and natural world. When the answer to a legal question depends on science, then one might expect the law to provide a warm welcome to the scientific evidence that helps answer the legal question. But it turns out to be more complicated than that.

Scientific evidence features in many legal disputes. The criminal law often engages various forensic disciplines and recently algorithms that promise scientific predictions about “dangerousness.” Judges are being asked to make crucial decisions such as granting bail and, if so, with what conditions using these algorithms. Criticisms of them raise equal protection and other important issues. Tort cases and medical malpractice cases often turn on questions relating to scientific evidence about substances or procedures. And courts review administrative agency determinations which often involve adjudicating scientific evidence. But judges are not usually scientists, nor even fluent in the scientific method much less the specific scientific disciplines that might be critical in litigation. And to complicate it further, the disciplines have conflicting methodology, vocabulary, and norms. Law puts a high price on certainty and finality. Science, on the other hand, is comfortable with uncertainty and with open questions. This tension permeates the law/science relationship.

*There is an inherent tension between law and science based on uncertainty.*

As a result, a judge’s job as the gatekeeper of scientific evidence can be a hard one.



### 3.2 OPINION EVIDENCE: THE GENERAL RULE

The general rule governing opinion evidence in court is familiar to judges: a witness should testify only about the facts she observed and should not give her opinion about those facts. The rule has a truth-seeking foundation; opinion evidence does not assist a jury or judge and might mislead it. A witness's subjective opinion about an issue in a case is irrelevant. It is for the jury or judge to draw subjective conclusions from the facts, and a witness's opinion interferes with that function. The judge, as gate-keeper, is trained to exclude opinion evidence from lay witnesses, so that the fact-finder can draw its own conclusions about the evidence.

### 3.3 SCIENTIFIC EVIDENCE AS OPINION EVIDENCE

This particular gatekeeping function is more nuanced with scientific evidence. The exception to the general rule barring opinion testimony is for expert opinions. And expert opinion is commonly how scientific evidence is introduced in litigation.

Expert scientific opinion evidence generally is admissible when a witness's education, training, skill, or experience gives expertise and specialized knowledge in a particular subject beyond that of the average person. The expert's opinion is admissible to assist the fact-finder. Expert witnesses also may testify about facts within their field of expertise. An expert's opinion must be based on admissible evidence. The expert is expected to give the factfinder the evidentiary basis for her opinion so that the factfinder can form an independent judgment about the expert's opinion.

There are jurisdiction-specific rules which govern what scientific opinion evidence can make its way into a proceeding and how so. In the federal system and in many states, understanding the legal architecture around the admission of scientific opinion evidence requires understanding *Daubert v. Merrell Dow Pharmaceuticals, Inc.* 509 U.S. 579 (1993) and Federal Rule of Evidence (FRE) 702.

Before FRE 702 was enacted, courts determined the admissibility of testimony about novel scientific evidence by whether it has “gained general acceptance in the particular field in which it belongs.”<sup>1</sup> The trial court was the gatekeeper and was expected to defer to experts in the field in making the determination. In 1993 the Supreme Court held in *Daubert* that the *Frye* test was superseded by the 1975 Federal Rules of Evidence, and specifically by Rule 702 yet seven states still use the *Frye* standard. The *Daubert* Court held that the rules governing expert evidence simply did not support the idea “that ‘general acceptance’ is an absolute prerequisite to admissibility” of scientific evidence. Moreover, such “a rigid ‘general acceptance’ requirement would be at odds with the Rules’ liberal thrust and their ‘general approach of relaxing the traditional barriers to ‘opinion’ testimony.”<sup>2</sup>



FRE 702 permits a qualified expert to testify about her opinion if:

- 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 the principles and methods to the facts of the case.

Every jurisdiction has a rule of evidence governing expert opinion evidence, and in most states it is codified as Rule 702. But whether a state uses the *Daubert* or *Frye* standard, some other standard, or a combination of both standards is jurisdiction specific. *Appendix 1* summarizes each state's approach.



### 3.4 WHAT DISTINGUISHES SCIENTIFIC AND TECHNICAL EVIDENCE

The expert opinion rule is not limited to scientific evidence. Rather, it governs “scientific, technical, or other specialized knowledge” which requires an understanding of what distinguishes scientific evidence from technical evidence. The difference between scientific and technical evidence became especially relevant after *Daubert*, as the expert opinion evidence at issue in the case was scientific and some questioned whether the *Daubert* standard should apply equally to technical evidence. That particular debate is salient in few jurisdictions today as *Kumho Tire, Ltd. v. Carmichael*, 526 U.S. 137 (1999), which held that *Daubert* applies not only to scientific testimony but also to technical testimony unrelated to a pure science, settled it.

*The ultimate question is: “Does the expert opinion assist the finder of fact?”*

Exactly which disciplines are more technical than scientific can be a hard determination, and one about which reasonable people can disagree. For example, before *Kumho Tire* was decided, some fire investigators believed that their discipline was not a science but more a matter of technical evidence and was therefore not subject to *Daubert*. In any jurisdiction that has adopted *Daubert* but not adopted *Kumho Tire*, arson investigation might be an example of a technical discipline.<sup>3</sup> In these jurisdictions technical evidence that is not tied to a specific science is not subject to the *Daubert* standard.

### 3.5 EXPERT OPINION

Nor are the rules governing expert opinion testimony limited to scientific and technical evidence. FRE 702 permits expert opinions about all “specialized” knowledge and an expert is any person qualified by “knowledge, skill, experience, training or education.” Expert opinions can take many forms: scientific experts, forensic experts, accounting experts, vocational experts, and any other area where a witness has specialized training and education. In many criminal cases, police officers are called to testify as experts about specific criminal activity.

The question for the court will always be whether the expert opinion will assist the factfinder. Disputes around this question are common. The judge’s job is to determine whether a particular question is one that a lay jury can decide without the help of someone with specialized knowledge. Expert opinions should be excluded when they are unhelpful and thus superfluous and a waste of time.<sup>4</sup>

### 3.6 DISTINGUISHING EXPERT SCIENTIFIC OPINION FROM OTHER EXPERT OPINION

The difference between scientific expert opinion and other expert opinion is important. As already explained, technical evidence might well be subject to *Daubert*, if a jurisdiction has adopted *Kuhmo Tire*. But expert opinion neither scientific nor technical isn't always a great fit for *Daubert* or *Frye*. For example, it is not uncommon for a litigant to offer a police officer as an expert in gang activity. This subject of how gangs behave isn't scientific or technical, but, the argument goes, the officer's opinion is based on her "specialized knowledge" from her experience. And while the *Daubert* decision does not govern this non-scientific, non-technical category of expert testimony, FRE 702 does not exempt it from its requirements. This may mean that it is harder for the proponent of that testimony to satisfy the rule.



### 3.7 LEGAL VS. SCIENTIFIC STANDARDS

As the preceding sections have shown, the intersection of legal and scientific standards can be complicated. The scientific method encompasses norms and practices for conducting experiments to test a concept, observing the results, making inferences from them and then testing those inferences with further experimentation. In other words, the “truth” is always in development. And scientific disciplines have safeguards for ensuring research and conclusions are sound such as peer review, controlled testing, and error rates.

This approach is categorically different than the legal process. Courts have borrowed some of these tools to determine whether scientific evidence should be admissible. However, the trial is the entire universe of evidence from which the factfinder makes a final decision, and that is the end of the question. Therefore for purposes of sorting out that legal truth, often the law follows slowly behind science, as sciences need to be fairly established (even if not universally accepted) before they become properly admissible in court.

This is so because of concerns of due process and fundamental fairness. The common law structure for trials used in the United States, which at its core relies on constitutional rules to control the admission of evidence, exists to prevent inaccurate factual final judgments.

The Sixth Amendment right to confront a witness was created to furnish a procedure to exclude evidence against an accused when its reliability cannot be tested at trial.

In other words, the stakes are different and thus the standards are too. Scientific standards for integrity and reliability are only a starting point for courts in determining legal admissibility. It is also suggested that (a) when scientists and lawyers talk about facts or evidence, each means something different, because (b) differences between science and law are hidden by similarities; and (c) institutional or procedural changes must address (a) and (b) if they are to succeed.

*Scientific standards for integrity and reliability are only a starting point to determine admissibility.*



### 3.8 CYBER AND DIGITAL EVIDENCE

The use of Electronically Stored Information (ESI) as evidence at trial has become commonplace. For the court to determine its admissibility properly, it must have a general understanding of the technology and the issues that will determine whether its proponent has properly established its authenticity. Most courts in the United States that have addressed the admissibility of ESI and provided analysis on its admission have applied the Federal Rules of Evidence, and specifically FRE 901. This section will too.

*The determination of authenticity of ESI will require the court to develop an understanding of the technology underlying the proposed ESI*

ESI is digital evidence. There is not one single exhaustive list of categories of ESI. “ESI comes in multiple ‘flavors,’ including e-mail, website ESI, internet postings, digital photographs, and computer-generated documents and data files.”<sup>5</sup> “Examples of internet postings include data posted by the site owner, data posted by others with the consent of the site owner, and data posted by others without consent, such as by ‘hackers.’ Examples of computer-generated documents and files include electronically stored records or data, computer simulation, and computer animation.”<sup>6</sup>

After the determination of whether the proffered ESI evidence is relevant, a court will need to conduct a detailed inquiry into its authenticity. The determination of authenticity of ESI will require the court to develop an understanding of the technology underlying the proposed ESI, which in turn will enable the court to ask the right questions and appropriately weigh the foundation evidence for its introduction.

Because of the underlying technologies involved in creating and storing ESI, it may have characteristics that make it extremely reliable and probative, but it also may have characteristics that create doubt about its authenticity. The court should recognize this when reviewing the admission of ESI into evidence.

Digital evidence is different than traditional evidence. Digital evidence is easily modifiable. But the fact that it is potentially modifiable is not enough to establish its untrustworthiness.<sup>7</sup> Although a court may decide based on the circumstances not to presume ESI has been modified, the fact that it could be modified, because of advances in technology, create authenticity issues about which courts should be aware. For instance, it has become easier to change the text in scanned documents. In addition to human tampering of evidence, data can be improperly or unexpectedly altered because of a computing error that is user caused or the result of a software defect.

Although ESI is subject to modification that can potentially affect its admissibility, there are positive characteristics of ESI. ESI is difficult to destroy, it is easily duplicated and it is potentially more expressive.

When considering the introduction of ESI, it is important to know how the ESI was created, stored, retrieved and preserved. Whether the ESI is recovered as a result of a warrant or through discovery, ESI obtained/seized should be frozen upon being obtained (“seizing and freezing”) to ensure its authenticity.

When someone (including a forensic examiner) obtains ESI from a system, the court will also need to determine whether the activities of the person obtaining the ESI from the system or anyone else modified the data. This inquiry will need the competency of the person who obtained the data and a review of the documentation setting forth how the data were seized/obtained, accessed, stored and transferred to the medium presented to the court.<sup>8</sup> Sufficient documentation must be maintained by the person obtaining the ESI from the system for the court to make a proper determination of its admissibility. Merely accessing data may alter it; thus courts must undertake to determine what alterations may have taken place when assessing the authenticity of ESI being offered into evidence. For instance, if the date that a file was last accessed is the relevant question, simply accessing that file for the pending proceedings by someone inexperienced at preserving ESI in its unaltered form may change the date it was last accessed, thereby altering the proffered evidence.

If ESI results from software processing data inputted, it will be important to understand how the data were first entered, i.e., its source and whether it was entered accurately without interpretation or opinion, or whether there was opinion and analysis applied to the data ultimately inputted.<sup>9</sup> Additionally, the court should review the measures taken to verify the accuracy of any software that processes data.<sup>10</sup> This is ultimately a two-step inquiry for the court to undertake: first, the admissibility of the entered data must be analyzed; and second, the admissibility of the processed data must be analyzed.

The proponent's ability to demonstrate to the court that the data stored on the computer was merely stored and not altered will resolve many authentication issues. Once stored data has been processed to derive new or different data, additional authentication issues will arise. In *In re Vee Vinhnee*, 336 BR 437, 444 (BAP 9th Cir. 2005), one court's admission analysis of ESI was:

*Electronically  
Stored Information  
must be shown to  
be an accurate  
representation of  
the record that was  
originally created.*

The primary authenticity issue in the context of business records is on what has, or may have, happened to the record in the interval between when it was placed in the files and the time of trial. In other words, the record being proffered must be shown to continue to be an accurate representation of the record that originally was created.<sup>11</sup>

Authenticity of ESI under FRE 901 will require evidence sufficient to show that the evidence in question is what the proponent claims.<sup>12</sup> This means that the proponent must be able to demonstrate that the record that has been retrieved from the file is the same as the record originally placed into the file.<sup>13</sup> This may be satisfied by:

1. a competent witness,<sup>14</sup>
2. a "process or system" used to produce the result and showing that the process or system produces an accurate result,<sup>15</sup> or
3. "the appearance, contents, substance, internal patterns, or other distinctive characteristics of the item taken together with all the circumstances."<sup>16</sup>



This list is not exhaustive.

The *In re Vee Vihnee* Court explained FRE 901(b)(9) in further detail:

Rule 901(b)(9), which is designated as an example of a satisfactory authentication, describes the appropriate authentication for results of a process or system and contemplates evidence describing the process or system used to achieve a result and demonstration that the result is accurate.<sup>17</sup> The advisory committee note makes plain that Rule 901(b)(9) was designed to encompass computer-generated evidence and also that it did not preclude taking judicial notice in appropriate circumstances.<sup>18</sup>

To determine whether ESI has been altered or manipulated, its proponent should have some form of audit procedures to assure the integrity of the records, which may include records of regular testing the computer and its software for potential errors.<sup>19</sup> A witness supporting the authentication of ESI should be able to “testify as to the mode of record preparation, that the computer is the standard acceptable type, and that the business is conducted in reliance upon the accuracy of the computer in retaining and retrieving information.”<sup>20</sup>

Professor Edward J. Imwinkelried set forth an eleven-step inquiry for electronic business records, which serves as an excellent framework to analyze the authenticity of ESI.<sup>21</sup> Professor Imwinkelried perceives electronic records as a form of scientific evidence and employs this eleven-step foundation for computer records:

1. The business uses a computer.
2. The computer is reliable.
3. The business has developed a procedure for inserting data into the computer.
4. The procedure has built-in safeguards to ensure accuracy and identify errors.
5. The business keeps the computer in a good state of repair.



6. The witness had the computer readout certain data.
7. The witness used the proper procedures to obtain the readout.
8. The computer was in working order at the time the witness obtained the readout.
9. The witness recognizes the exhibit as the readout.
10. The witness explains how he or she recognizes the readout.
11. If the readout contains strange symbols or terms, the witness explains the meaning of the symbols or terms for the trier of fact.

Once the proponent of ESI can demonstrate through a *prima facie* showing that the evidence is what it is claimed to be, then the opponent's claimed flaws about its authenticity will go to its weight, not its admissibility.<sup>22</sup>

Throughout a court's assessment of ESI, additional issues may arise. Although not all digital evidence is hearsay, some of it is in which case, the court will need to determine whether one of the hearsay exceptions under FRE 803, 804 or 807 apply. For instance, "[w]here postings from internet websites are not statements made by declarants testifying at trial and are offered to prove the truth of the matter asserted, such postings generally constitute hearsay under Fed. R. Evid. 801."<sup>23</sup>

The next step in determining the admissibility of electronic evidence is to analyze issues associated with Fed. R. Evid. 1001-1008. The *Lorraine* Court provides a detailed analysis of the issues associated with the original writing rule.<sup>24</sup>

The last step in determining the admissibility of electronic evidence is to analyze it to determine whether its probative value outweighs any unfair prejudice.<sup>25</sup>

### 3.9 ENDNOTES

1. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).
2. *Daubert v. Merrell Dow Pharmaceuticals, Inc.* 509 U.S. 579, 588 (1993).
3. *But see Michigan Millers Mut. Ins. Corp. v. Benfield*, 140 F.3d 915 (11th Cir. 1998).
4. 7 J. WIGMORE, WIGMORE ON EVIDENCE § 1918.
5. *Lorraine v. Markel American Ins Co*, 241 F.R.D. 534, 538 (D.Md. 2007).
6. *Id.*, 241 F.R.D. at 538 n. 4, citing 2 MCCORMICK ON EVIDENCE § 227 (John William Strong, et al. eds., 6th ed. 2006); Gregory P. Joseph, *Internet and Email Evidence*, 13 PRAC. LITIGATOR (Mar 2002), *reprinted* in 5 STEPHEN A. SALTZBURG, ET AL., FEDERAL RULES OF EVIDENCE MANUAL § 4 at 20 (9th ed. 2006); Paul W. Grimm & Claudia Diamond, *Low-Tech Solutions to High-Tech Wizardry: Computer Generated Evidence*, 37 MD. B.J. 4 (July/August 2004).
7. *United States v. Bonallo*, 858 F.2d 1427, 1436 (9th Cir. 2013).
8. DANIEL J. RYAN & GAL SHPANTZER, LEGAL ASPECTS OF DIGITAL EVIDENCE (2016), at 3-4.
9. *United States v Scholle*, 553 F.2d 1109, 1125 (8th Cir. 1977).
10. *Id.*
11. *In re Vee Vinhnee*, 336 B.R. 437, 444 (B.A.P. 9th Cir. 2005).
12. FRE 901(a); *See also United States v Lubich*, 72 M.J. 170 (2013).
13. FRE 901(a).
14. FRE 901(b)(1).
15. FRE 901(b)(9).
16. FRE 901(b)(4).
17. FRE 901(b)(9).
18. *In re Vee Vinhnee*, 336 B.R. at 446.
19. *Id.* at 445.
20. *Id.* at 445-446 (citing BARRY RUSSELL, BANKRUPTCY EVIDENCE MANUAL, at § 803.17 (2005) (“Russell”); *cf.* 5 Weinstein § 900.07[1][c]).

21. *In re Vee Vinhnee*, 336 B.R. at 446, *citing* EDWARD J. IMWINKELRIED, EVIDENTIARY FOUNDATIONS (5th ed. 2002).
22. *Lubich*, at 174 (2013)
23. *People v Johnson*, 51 Misc.3d 450, 465 (2015).
24. *Lorraine v. Markel American Ins Co*, 241 F.R.D at 576-583.
25. *Id.*



An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. Scattered throughout the background are small, light-colored numbers (0-9) in a random distribution.

# 3. SCIENTIFIC EVIDENCE

## Section 3.10 Forensic Pattern Evidence

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**MARC PICKER, ESQ.**

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### 3.10.1 Introduction

Science favors neither prosecution nor defense, plaintiff nor defendant. Science, like the judiciary, is neutral. As we learn more about forensic scientific techniques and as more sophisticated research is done, assumptions we have held for years are no longer standing up to the scrutiny required by current case law. Theories continue to be tested and judges are tasked with keeping up to date on the latest knowledge. It is the job of the trial judge to decide what evidence is scientifically valid under applicable legal standards and to allow or disallow certain evidence regardless of which side is proffering it.

Science is constantly challenging itself by continuing to test hypotheses and theories. Everything is fluid. The law, by contrast, favors settled questions and is slow to move away from long held beliefs and decisions. This constant tension between law and science makes it particularly difficult for judges to decide what should come in and what should stay out of evidence.

*This constant tension between law and science makes it particularly difficult for judges to decide what should come in and what should stay out of evidence.*

In this section, there is an introduction about admissibility issues involving forensic pattern evidence followed by specific types of such evidence. Each specific type includes a sampling of cases and the scientific basis surrounding it. The types included are: Firearm/ Tool Marks; Questioned Documents; Trace Evidence; Biological/Serology Screening; Impression Evidence; Blood Pattern Evidence; and, Shaken Baby Syndrome. In analyzing forensic pattern evidence and its use in current justice contexts, this section will examine some of the more common types of such evidence.

Over the last two decades, advances in forensic science disciplines, especially the use of DNA technology, have demonstrated great potential to help law enforcement identify criminals. Many crimes that may have gone unsolved are now being solved because forensic science is helping to identify the perpetrators.



Those advances, however, also have revealed that, in some cases, substantive information and testimony based on faulty forensic science analyses may have contributed to wrongful convictions of innocent people.<sup>1</sup>

Forensic pattern evidence encompasses a variety of techniques to associate items of physical evidence through comparison analyses to certain individuals.<sup>2</sup> Fingerprinting is perhaps the most well-known type of forensic pattern evidence, but others include firearm and tool marks, questioned documents including handwriting, trace evidence, biological/serology screening for hair comparison or blood typing, and impression evidence including blood pattern or spatter evidence, among others.<sup>3</sup>

Forensic examination follows a four-step process named ACE-V for Analysis, Comparison, Evaluation, and Verification.<sup>4</sup> The first three steps identified by the abbreviation ACE—analysis, comparison, and evaluation—as presented by Huber and Headrick,<sup>5</sup> based on the early publications by Huber.<sup>6</sup> The concept of conducting a sequential set of tasks distinguishing analysis from comparison goes back to the early days of forensic science. The verification step was subsequently added by forensic specialist David R. Ashbaugh<sup>7</sup> for fingerprint examination and adopted on most pattern comparison areas.

In recent years, there has been increasing concern about faulty forensic science. Recently the FBI acknowledged that the Bureau overstated the accuracy of hair sample matches over ninety-five percent of the time.<sup>8</sup> Other evidence, of patterns and impressions like bite marks and blood spatter, have been regularly used but are now being questioned.

The publication of the National Research Council *Strengthening Forensic Science in the United States* in 2009 echoed many criticisms of forensic pattern evidence and supported that with the credibility of the nation's leading scientific institution stating:<sup>9</sup>

The forensic science system, encompassing both research and practice, has serious problems that can only be addressed by a national commitment to overhaul the current structure that supports the forensic science community in this country.

The concerns led to an effort to initiate a system to govern, regulate, and improve forensic science by the United States Department of Justice (DOJ) and the National Institute of Standards and Technology, as well as the National Academies, the American Association for the Advancement of Science, and the National Science Foundation.<sup>10</sup>

A recent development was the issuance of a memorandum by the Office Attorney General Eric Holder on September 6, 2016<sup>11</sup> instructing forensic scientists working in federal laboratories to no longer use the phrase “reasonable degree of scientific certainty” in court testimony. This memorandum directed forensic laboratories to review their policies and procedures to ensure that forensic examiners do not use either “reasonable degree of scientific certainty” or “reasonable degree of [forensic discipline] certainty.” The DOJ based this policy change, in part, upon the idea that “scientific method” does not support the use of such language.

Since 1993, federal and most state courts have used the *Daubert* Standard (See Section 7.2.3 ) to determine whether scientific testimony is admissible as evidence. Under the standard, testimony can be admitted only if the expert can prove that the technique or theory used can be tested; has been peer reviewed; has a known error rate, standards and controls; and, is “generally accepted in the scientific community.”<sup>12</sup>

Studies by the National Research Council<sup>13</sup> and the President’s Council of Advisors on Science and Technology<sup>14</sup> have suggested that there is insufficient scientific research to support the claims of the broad field of “pattern matching” forensics, which includes analyses of such things as hair fiber, bite marks, “tool marks” and tire tread. These two reports question the extent of the underlying scientific research supporting these forensic specialties. The President’s Council highlighted the finding in the original National Research Council report:<sup>15</sup>

[M]uch forensic evidence—including, for example, bitemarks and firearm and toolmark identifications—is introduced in criminal trials without any meaningful scientific validation, determination of error rates, or reliability testing to explain the limits of the discipline.



As Betty Layne DesPortes, J.D., M.S., former president of the American Academy of Forensic Sciences, in an interview with Science Friday concluded:<sup>16</sup>

Law enforcement has relied on these disciplines for so long, and they believe in them. It's very difficult for them to appreciate the fact that, because they did not arise in science—like DNA and some of the other chemistry disciplines did—that these techniques lack some of the validation studies necessary to prove their worth and their reliability.

#### 3.10.2 Firearms/Tool Marks

##### ADMISSIBILITY

The decision to allow such evidence is part of the court's gatekeeping function as applied to expert testimony. Questions concerning subjective vs. objective method of analysis is the main concern. Various courts have addressed the admission of firearm tool mark evidence, and almost always have allowed the admission of such evidence. The caveat appears to be how the analyst is allowed to frame their expert opinion: whether as an "identification," an "elimination" or simply as a "degree of certainty" that the marks in question were made by "particular" or "specific" firearm or a "similar" one and whether that opinion is required to be enunciated as being to "a reasonable degree of scientific certainty," now a disfavored phrase.

##### DESCRIPTION/EXPLANATION OF THE SCIENCE

As explained in the Report To The President *Forensic Science In Criminal Courts*:<sup>17</sup> Ensuring Scientific Validity Of Feature-Comparison Methods, Executive Office Of The President, presented by the President's Council Of Advisors On Science And Technology in September 2016, firearms analysis attempts to determine whether ammunition is or is not associated with a specific firearm based on tool marks produced by guns on the ammunition.<sup>18</sup> This is based upon a determination that gun barrels are typically rifled to improve accuracy (i.e., spiral grooves are cut into the barrel's interior to impart spin on the bullet). Examiners work to determine whether imperfections produced during the tool-cutting process and through "wear" through the use of the firearm leave individualized marks on bullets or casings as they exit



the firearm.<sup>19</sup> For example, analysts compare cartridge cases recovered from a crime scene to a gun recovered at that scene or from a suspected perpetrator.

Much attention in this scientific discipline has focused on trying to prove the notion that every gun produces ‘unique’ tool marks. In 2004, the NIJ [National Institute of Justice] asked the NRC [National Research Council] to study the feasibility, accuracy, reliability, and advisability of developing a comprehensive national ballistics database of images from bullets fired from all, or nearly all, newly manufactured or imported guns for the purpose of matching ballistics from a crime scene to a gun and information on its initial owner.

In its 2008 report, a NRC committee, responding to NIJ’s request, found that the validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks had not yet been demonstrated and that, given current comparison methods, a database search would likely ‘return too large a subset of candidate matches to be practically useful for investigative purposes.’<sup>20, 21</sup>

While “matching” a cartridge to a particular gun is a goal, it is not the only evidentiary use of such tool marks.<sup>22</sup> But, it is essential that an expert proposing such evidence provide the accuracy of the method for comparing them in testimony.<sup>23</sup>

In its 2009 study, the NRC reviewed firearm/tool mark analysis, with the following conclusions.

Tool mark and firearms analysis suffers from the same limitations . . . for impression evidence. Because not enough is known about the variabilities among individual tools and guns, we are not able to specify how many points of similarity are necessary for a given level of confidence in the result. Sufficient studies have not been done to understand the reliability and repeatability of the methods. The committee agrees that class characteristics are helpful in narrowing the pool of tools that may have left a distinctive mark. Individual



patterns from manufacture or from wear might, in some cases, be distinctive enough to suggest one particular source, but additional studies should be performed to make the process of individualization more precise and repeatable.

A fundamental problem with tool mark and firearms analysis is the lack of a precisely defined process . . . . [The Association of Firearm and Tool Mark Examiners] (AFTE) has adopted a theory of identification, but it does not provide a specific protocol. It says that an examiner may offer an opinion that a specific tool or firearm was the source of a specific set of tool marks or a bullet striation pattern when ‘sufficient agreement’ exists in the pattern of two sets of marks. It defines agreement as significant ‘when it exceeds the best agreement demonstrated between tool marks known to have been produced by different tools and is consistent with the agreement demonstrated by tool marks known to have been produced by the same tool.’ The meaning of ‘exceeds the best agreement’ and ‘consistent with’ are not specified, and the examiner is expected to draw on his or her own experience. This AFTE document, which is the best guidance available for the field of tool mark identification, does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence.<sup>24</sup>

A 2014 NIJ study, described in a journal article —“Study Identifies Ways to Improve ATF Ballistic Evidence Program”—looked at the operation of the National Integrated Ballistic Information Network (NIBIN), not at the underlying science of firearm and tool mark examination.<sup>25</sup> This forensic science—sometimes referred to by laypeople as “ballistics”—is concerned with the validity of matching a fired bullet to a particular firearm.<sup>26</sup> The study specifically looked at the current state of the science of firearm and tool mark examinations and whether they are accurate, reliable and valid.<sup>27</sup> The study—a collaboration between a Florida International University statistician and the Miami-Dade Police Department (which has been studying Glock barrels since 1994)—found that the examiners correctly matched the spent bullet to the barrel that fired it 98.8 percent of the time.<sup>28</sup>

The scientific criteria for foundational validity require appropriately designed studies by more than one group to ensure reproducibility.<sup>29</sup> In order to validate ballistic tool mark evidence,<sup>30</sup> there is a need for additional, appropriately designed black-box studies.<sup>31</sup>

In addition to tool mark analysis, past courts have allowed testimony regarding “Comparative Bullet Lead Analysis” (CBLA) based upon [the Federal Bureau of Investigation] (FBI) comparisons.<sup>32</sup> This type of analyses occurred when a bullet was recovered from a crime scene and the bullet was too deformed for an expert to compare its striations to those on bullets fired from the defendant’s weapon. The FBI previously resorted to CBLA, analyzing seven elements in the crime scene bullet and bullets recovered from the defendant’s possession.<sup>33</sup> An expert often relied on CBLA as a basis for opining that the bullets came from the same batch (a single day’s manufacturing production) or the same box recovered from the defendant.<sup>34</sup> But CBLA critics pointed out that even the limited testimony about a batch is valid only if each batch is unique and uniform.<sup>35</sup> Later analyses of bullet-manufacturer data indicated that neither assumption was true.<sup>36</sup> A 2004 National Research Council report endorsed that criticism, and the FBI discontinued the use of CBLA.<sup>37</sup>

### 3.10.3 Questioned Documents (Including Handwriting, Ink, Ink Marks)

#### ADMISSIBILITY

Courts are split about the admissibility of forensic examination of documents expert testimony.<sup>38</sup>

#### DESCRIPTION/EXPLANATION OF THE SCIENCE

Questioned document examination involves comparison of documents and printing and writing instruments in order to identify or eliminate persons as the source of the handwriting; to reveal alterations, additions, or deletions; or to identify or eliminate the source of typewriting or other impression marks. Questions about documents



arise in business, finance, and civil and criminal trials, and in any matter affected by the integrity of written communications and records. Typical analyses include:

- determining whether the document is the output of mechanical or electronic imaging devices such as printers, copying machines, and facsimile equipment;
- identifying or eliminating particular human or machine sources of handwriting, printing, or typewriting;
- identifying or eliminating ink, paper, and writing instrument;
- establishing the source, history, sequence of preparation, alterations or additions to documents, and relationships of documents;
- deciphering and restoring obscured, deleted, or damaged parts of documents;
- recognizing and preserving other physical evidence that may be present in documents; and
- determining the age of a document.<sup>39</sup>

Questioned document examiners are also referred to as forensic document examiners or handwriting experts; questioned document examination includes the field of handwriting identification, while handwriting includes cursive or script style writing, printing by hand, signatures, numerals, or other written marks or signs. Forensic document examination does not involve a study of handwriting that purports to create a personality profile or otherwise analyze or judge the writer's personality or character.<sup>40</sup>

The validity of handwriting analysis has improved through recent empirical studies of the individuality and consistency of handwriting and computer studies which suggests that there may be a scientific basis for handwriting comparison, at least in the absence of intentional obfuscation or forgery.<sup>41</sup> Because of this increased study and based upon the proven reliability and replicability of the practices used by trained document examiners, the NRC found there to be “some value in handwriting analysis.”<sup>42</sup>

The extensive scrutiny of the methods and findings of numerous areas of expert testimony following the *Daubert* trilogy has prompted acrimonious debate among academicians, forensic practitioners, and legal professionals concerning what has been referred to by the Forensic Science Committee of the National Academy of Sciences as ‘faulty forensic science analyses.’ The field of forensic document examination consists of a wide array of specialized tasks related to the history and preparation of questioned documents. Forensic document examiners (FDEs) identify the source of handwriting and hand printing, distinguish among genuine, forged, traced, or disguised writing; to analyze inks, papers, and other substances related to documents, and perform other scientific or technical analyses requiring highly specialized skills. Handwriting analysis is based on the premise that handwriting is based on physiological and neurological foundations. Handwriting is a behavioral artifact, identifiable by the presence of features and characteristics within the writing (e.g., signatures, hand printing, numerals). The combination of these features individualizes the habit pattern of the writer. Thus, the two primary tenets of handwriting analysis are: (1) no two people write exactly alike in all features and characteristics when considered cumulatively and in combination (inter-writer variation); and (2) a person does not write exactly the same way twice (intra-writer variation). One important issue which has not been adequately resolved by extant research is information about the validity of forensic document examination.<sup>43</sup>

### 3.10.4 Trace Evidence

#### ADMISSIBILITY

The question of admissibility for trace evidence hinges on the type of evidence offered to be admitted. While soil samples or matching certain types of materials have been admitted (although testimony is most often limited to being “similar” in nature or “having the presence” of a certain chemical or compound), other evidence has been excluded such as comparative analysis of bullet lead or “identical” nature of two samples of a material or compound including gasoline or insulation.<sup>44</sup>





#### DESCRIPTION/EXPLANATION OF THE SCIENCE

Trace evidence is commonly defined at the conceptual level as follows:

- the surviving evidence of a former occurrence or action of some event or agent; and
- a very small amount of substance, often too small to be measured.

At a more practical level, trace evidence is defined as the analysis of materials that, because of their size or texture, transfer from one location to another and persist there for some period of time. Microscopy, either directly or as an adjunct to another instrument, is involved. In this context size matters; typical examples of trace evidence include fibers, hairs, glass fragments, paint chips, soil, botanical traces, gunshot residues, etc.<sup>45</sup>

With the advances in forensic science, there has been growing acceptance of trace evidence where such evidence points to more basic material or physical information on a suspected crime. At the same time, the absence of trace evidence or the presence of trace evidence that contradicts or does not agree with the theory of the crime may have just as much significance in considering the case being investigated.<sup>46</sup>

Trace evidence did not get a lot of analysis in the NAS report, other than criticisms regarding areas of testing such as microscopic hair examination.<sup>47</sup> Trace evidence analysis relies upon on science that has been used by experts outside of the criminal justice arena, and thus has enjoyed more independent confirmation.<sup>48</sup> In making an evidentiary determination courts should consider the nature of the testimony and the qualifications of the presented expert to determine whether their level of experience and adherence to accepted scientific principles was used to interpret analytical results.

### 3.10.5 Biological/Serology Screening (Hair, Fingernails, Blood Type, Etc.)

#### 3.10.5.1 Serology

##### ADMISSIBILITY

When evaluating forensic tests on suspected blood, semen, or saliva evidence, it is important to understand the difference between presumptive and confirmatory tests and why that distinction is so important.

Presumptive Tests are also known as preliminary tests, screening tests or field tests. Presumptive tests are used to establish the possibility that a specific bodily fluid is present, but they do not conclusively prove the presence of a specific substance. **Pros:** Narrows possibilities, can be used on larger areas, and can locate possible evidence not visible to naked eye. **Cons:** Risk of false positives and may be overly sensitive. **Uses:** Provide initial information to determine what test to perform next, used in combination with confirmatory tests.

Confirmatory Tests—Conclusively identify a biological material. May be one or a combination of procedures. **Pros:** Conclusively identifies a substance, smaller risk of false positives. **Cons:** May be more expensive, require additional equipment, and take longer.<sup>49</sup>

##### DESCRIPTION/EXPLANATION OF THE SCIENCE

Biological evidence is provided by specimens . . . that are available in a forensic investigation. Such specimens may be found at the scene of a crime or on a person, clothing, or weapon. Some—for example, pet hairs, insects, seeds, or other botanical remnants—come from the crime scene or from an environment through which a victim or suspect has recently traversed.<sup>50</sup> Other biological evidence comes from



specimens obtained directly from the victim or suspect, such as blood, semen, saliva, vaginal secretions, sweat, epithelial cells, vomitus, feces, urine, hair, tissue, bones, and microbiological and viral agents.<sup>51</sup> The most common types of biological evidence collected for examination are blood, semen, and saliva. Human biological evidence that contains nuclear DNA can be particularly valuable because the possibility exists to associate that evidence with one individual with a degree of reliability that is acceptable for criminal justice.<sup>52</sup>

#### *3.10.5.2 Hair analysis*

##### **ADMISSIBILITY**

The question of admissibility of expert testimony regarding hair comparison analysis or testing of hair samples has changed significantly in recent years as noted by University of California Davis School of Law Professor Edward Imwinkelried in an analysis of forensic evidence:

In an FBI study of 268 microscopic hair analysis cases, reviewers found that prosecution experts had overstated at 96% of the trials. Another FBI study compared microscopic hair analysis opinions with [mitochondrial DNA] (mtDNA) test results. In 11% of the cases in which the analysts opined that the defendant was a possible source of the two ‘microscopically indistinguishable’ hair samples, the DNA established that the defendant was not the source. In 2016, a Massachusetts Superior Court granted a new trial because the mtDNA research had gravely undermined confidence in microscopic hair analysis.<sup>53</sup>

The key question appears to be not whether experts in hair comparison analysis can testify—as almost all courts allow such testimony—but the way their conclusions are stated. It appears that most courts do not limit such testimony based upon most recent FBI guidelines, which provide for stating that samples are “consistent with” or “similar to” each other and not identical or unequivocally from the same person.<sup>54</sup>

## DESCRIPTION/EXPLANATION OF THE SCIENCE

The basis for the forensic use of hair comparison analyses starts from the fact that humans shed hair constantly and so may be picked up or transferred to another individual at a crime scene. Forensic hair examiners look for various physical characteristics which can be identified as coming from a particular group of people or even a particular person based on some unique characteristics.<sup>55</sup> Testimony should be allowed only to the effect that the sample could have come from a person in question, but not that it is unique to a single individual.<sup>56</sup> Most often this information can be used to include or exclude a person from a group that could have contributed the hair being analyzed. But care must be taken in such analysis because human hairs from different parts of the body are likely to have very different characteristics.<sup>57, 58</sup>

*Testimony linking microscopic hair analysis with particular defendants is highly unreliable. Microscopic studies alone are of limited probative value.*

As stated in *Strengthening Forensic Science* noted above,

[N]o scientifically accepted statistics exist about the frequency with which particular characteristics of hair are distributed in the population. There appear to be no uniform standards on the number of features on which hairs must agree before an examiner may declare a “match.” In one study of validity and accuracy of the technique, the authors required exact agreement on seven ‘major’ characteristics and at least two agreements among six ‘secondary’ characteristics. Further evaluation of probabilities in human hair comparisons. The categorization of hair features depends heavily on examiner proficiency and practical experience. An FBI study found that, of 80 hair comparisons that were ‘associated’ through microscopic examinations, 9 of them (12.5 percent) were found in fact to come from different sources when reexamined through mtDNA analysis. This illustrates not only the imprecision of microscopic hair analyses, but also the problem with using imprecise reporting terminology

such as ‘associated with,’ which is not clearly defined, and which can be misunderstood to imply individualization. In some recent cases, courts have explicitly stated that microscopic hair analysis is a technique generally accepted in the scientific community. But courts also have recognized that testimony linking microscopic hair analysis with particular defendants is highly unreliable. . . . In cases where there seems to be a morphological match (based on microscopic examination), it must be confirmed using mtDNA analysis; microscopic studies alone are of limited probative value. The [Committee on Identifying the Needs of the Forensic Science Community] found no scientific support for the use of hair comparisons for individualization in the absence of nuclear DNA. Microscopy and mtDNA analysis can be used in tandem and may add to one another’s value for classifying a common source, but no studies have been performed specifically to quantify the reliability of their joint use. [internal citations omitted]<sup>59</sup>

Similarly, the President’s Council of Advisors on Science and Technology (PCAST) analyzed forensic hair comparisons in its 2016 Report to The President *Forensic Science In Criminal Courts* noted above.<sup>60</sup> There, it found noted that it had reviewed the DOJ’s comment guidelines concerning testimony on hair examination that included supporting documents addressing the validity and reliability of the discipline.<sup>61</sup> The PCAST report expressed its concern in how the DOJ had addressed a 2002 FBI study on hair examination. In that 2002 study, FBI personnel used mtDNA analysis to re-examine 170 samples from previous cases in which the FBI Laboratory had performed microscopic hair examination.<sup>62</sup> The authors found that, in 9 of 80 cases (11 percent) in which the FBI Laboratory had found the hairs to be microscopically indistinguishable, the DNA analysis showed that the hairs actually came from *different* individuals.

The 2002 FBI study is a landmark in forensic science because it was the first study to systematically and comprehensively analyze a large collection of previous casework to measure the frequency of false-positive associations. Its conclusion is of enormous importance to forensic science, to police, to courts and to juries: *When hair examiners conclude in casework that two hair samples are*



*microscopically indistinguishable, the hairs often (1 in 9 times) come from different sources.*<sup>63</sup>

As the PCAST report concluded,

Our brief review is intended simply to illustrate potential pitfalls in evaluations of the foundational validity and reliability of a method. PCAST is mindful of the constraints that DOJ faces in undertaking scientific evaluations of the validity and reliability of forensic methods, because critical evaluations by DOJ might be taken as admissions that could be used to challenge past convictions or current prosecutions.

These issues highlight why it is important for evaluations of scientific validity and reliability to be carried out by a science-based agency that is not itself involved in the application of forensic science within the legal system . . . .

They also underscore why it is important that quantitative information about the reliability of methods (e.g., the frequency of false associations in hair analysis) be stated clearly in expert testimony . . . . DOJ's proposed guidelines . . . would bar examiners from providing information about the statistical weight or probability of a conclusion that a questioned hair comes from a particular source.

. . . [M]any forensic feature-comparison methods have historically been assumed rather than *established* to be foundationally valid based on appropriate empirical evidence. Only within the past decade has the forensic science community begun to recognize the need to empirically test whether specific methods meet the scientific criteria for scientific validity. Only in the past five years, for example, have there been appropriate studies that establish the foundational validity and measure the reliability of latent fingerprint analysis. For most subjective methods, there are no appropriate black-box studies with the result that there is no appropriate evidence of foundational validity or estimates of reliability.<sup>64</sup>



### 3.10.6 Impression Evidence

Impression evidence is created when an object leaves behind an indentation or mark. Impression evidence can be two-dimensional, like a fingerprint, or three-dimensional—like footwear imprints. This subsection will examine several types of impression evidence including fingerprints, footwear, tire marks and bite marks.

The general approach concerning the analytical sequence of various types of impression evidence, is based upon the concept that each has its own set of characteristics. For example, some types of impression evidence, such as those arising from footwear and tires, require knowledge of manufacturing and wear, while other types, such as ear prints and bloodstain patterns, do not. Because footwear and tire track impressions comprise the bulk of the examinations conducted, the remarks in this section are specifically focused on these analyses.

Experts in impression evidence argue that they accumulate a sense of those probabilities through experience, which may be true. However, it is difficult to avoid biases in experience-based judgments, especially in the absence of a feedback mechanism to correct an erroneous judgment.<sup>65</sup> These problems are exacerbated with the less common types of impression evidence. For example, a European survey found that 42 laboratories conducted 28,093 shoeprint examinations and 41 laboratories conducted 591 tire track examinations, but only 14 laboratories conducted a total of 21 lip print examinations and 17 laboratories conducted a total of 100 ear print examinations.

Part of the justification for the admission of impression evidence is that those who perform the work in laboratories that conduct hundreds or thousands of evaluations of impression evidence develop useful experience and judgment, however, there is still a lack of scientific data about the natural variability of those less frequent impressions, absent the presence of a clear deformity or scar, to infer whether the observed degree of similarity is significant. Most of the research in the field is conducted in forensic laboratories, with the results published in trade journals such as the *Journal of Forensic Identification*. The Scientific Working Group for Shoeprint and Tire Tread Evidence (SWGTHREAD) is moving toward the use of standard language to convey the conclusions reached. But neither the International Association for Identification (IAI) nor SWGTHREAD addresses the issue of

what critical research should be done or by whom; critical questions that should be addressed include the persistence of individual characteristics, the rarity of certain characteristic types, and the appropriate statistical standards to apply to the significance of individual characteristics. Also, little if any research has been done to address rare impression evidence. Much more research on these matters is needed.

### *3.10.6.1 Footwear*

#### ADMISSIBILITY

Courts have generally allowed footwear impression evidence. The limitations on the admission is similar to tool mark evidence where the expert is allowed to frame their opinion into general classification of similarity, rather than to a specific shoe identification.

#### DESCRIPTION/EXPLANATION OF THE SCIENCE

Footwear analysis is a process that typically involves comparing a known object, such as a shoe, to a complete or partial impression found at a crime scene, to assess whether the object is likely to be the source of the impression. The process proceeds in a stepwise manner, beginning with a comparison of ‘class characteristics’ (such as design, physical size, and general wear) and then moving to ‘identifying characteristics’ or ‘randomly acquired characteristics (RACs)’ such as marks on a shoe caused by cuts, nicks, and gouges in the course of use.<sup>66</sup>

*There are no appropriate empirical studies to support the association of shoeprints with particular shoes based on specific identifying marks.*

PCAST focused on the reliability of conclusions, based on RACs, that an impression was likely to have come from a specific piece of footwear. This is a much harder problem, because it requires knowing



how accurately examiners identify specific features shared between a shoe and an impression; how often they fail to identify features that would distinguish them; and, what probative value should be ascribed to a particular RAC<sup>67</sup>

The absence of empirical studies that measure examiners' accuracy, was cited in the NRC report casting doubt on whether footwear examiners reach consistent conclusions when presented with the same evidence.<sup>68</sup>

The PCAST report reached the following conclusion: "... [T]he fundamental issue is not one of *consistency* (whether examiners give the *same* answer) but rather of *accuracy* (whether they give the *right* answer).<sup>69</sup>

PCAST finds there are no appropriate empirical studies to support the foundational validity of footwear analysis to associate shoeprints with particular shoes based on specific identifying marks (sometimes called "randomly acquired characteristics"). Such conclusions are unsupported by any meaningful evidence or estimates of their accuracy and thus are not scientifically valid.<sup>70</sup>

#### 3.10.6.2 *Tire Impressions, etc.*

##### ADMISSIBILITY

Courts have generally allowed footwear impression evidence. The limitations to the admission is similar to tool mark evidence where the expert is allowed to frame their opinion into general classification of similarity, rather than to a specific shoe identification.

##### DESCRIPTION/EXPLANATION OF THE SCIENCE

The scientific basis for the evaluation of impression evidence is that mass-produced items pick up features of wear that, over time, individualize them.<sup>71</sup> However, because these features continue



to change as they are worn . . . or used, elapsed time after a crime can undercut the forensic scientist's certainty. At the least, class characteristics can be identified, and with sufficiently distinctive patterns of wear, one might hope for specific individualization. However, there is no consensus regarding the number of individual characteristics needed to make a positive identification, and the Committee on Identifying Needs of the Forensic Sciences Community, [NRC] is not aware of any data about the variability of class or individual characteristics or about the validity or reliability of the method.<sup>72</sup> Without such population studies, it is impossible to assess the number of characteristics that must match in order to have any particular degree of confidence about the source of the impression.<sup>73</sup>

### 3.10.6.3 *Bite Marks*

#### ADMISSIBILITY

The history of bite mark evidence is an example of the need for a better judicial understanding regarding the admissibility of scientific evidence.<sup>74</sup> California was the first state in 1975 to allow the admission of bite mark expert testimony in the case *People v. Marx*.<sup>75</sup> Three dentists claimed that they could match bite marks on the victim's nose to the teeth of the defendant.<sup>76</sup> California followed a federal guideline that allowed the defendant to challenge the scientific validity of scientific testimony, but the appeals court ruled that bite mark matching was less science than a matter of common sense.<sup>77</sup> Three years later, another California appeals court cited *Marx* in upholding bite mark testimony once again, noting the "superior trustworthiness of the scientific bite mark approach." But the *Marx* judges had explicitly noted that the analysis *wasn't* scientific. Nonetheless, other courts began citing the case. By 1987, 21 state appellate courts across the United States had accepted bite mark analysis, without a single

*Bite mark  
"evidence"  
has led to more  
than two dozen  
wrongful arrests  
and convictions.*



dissenting opinion. By 2004, courts in 37 U.S. jurisdictions had accepted it.<sup>78</sup>

#### DESCRIPTION/EXPLANATION OF THE SCIENCE

In its study, the NRC noted that “[a]lthough the identification of human remains by their dental characteristics is well established in the forensic science disciplines, there is continuing dispute over the value and scientific validity of comparing and identifying bite marks.”<sup>79,80</sup>

Despite the inherent weaknesses involved in bite mark comparison, it is reasonable to assume that the process can sometimes reliably exclude suspects. Although the methods of collection of bite mark evidence are relatively noncontroversial, there is considerable dispute about the value and reliability of the collected data for interpretation. Some of the key areas of dispute include the accuracy of human skin as a reliable registration material for bite marks, the uniqueness of human dentition, the techniques used for analysis, and the role of examiner bias . . . . The [American Board of Forensic Odontology] (ABFO) has developed guidelines for the analysis of bite marks to standardize analysis,<sup>81</sup> but there is still no general agreement among practicing forensic odontologists about national or international standards for comparison.

*“[There is] no evidence of an existing scientific basis for identifying an individual [using bite marks] to the exclusion of all others.*”

Although the majority of forensic odontologists are satisfied that bite marks can demonstrate sufficient detail for positive identification,<sup>82</sup> no scientific studies support this assessment, and no large population studies have been conducted. In numerous instances, experts diverge widely in their evaluations of the same bite mark evidence,<sup>83</sup> which has led to questioning of the value and scientific objectivity of such evidence.

Bite mark testimony has been criticized as lacking an existing scientific basis for identifying an individual to the exclusion of all others. That same finding was reported in a 2001 review, which “revealed a lack of valid evidence to support many of the assumptions made by forensic dentists during bite mark comparisons.”<sup>84</sup> Some research is warranted in order to identify the circumstances within which the methods of forensic odontology can provide probative value.<sup>85</sup>

Additionally, the NIJ noted:

The forensic methods that are most frequently associated with wrongful conviction cases are forensic serology (e.g., ABO blood typing and secretor status), microscopic hair analysis, and bite marks. However, the last case involving any of these three disciplines was in the late 1990s . . . . Over the years, the . . . ABFO has changed its guidance for associating bite mark impressions. In a December 2000 document,<sup>86</sup> the ABFO issued the following guidance: The term reasonable medical certainty conveys the connotation of virtual certainty or beyond reasonable doubt. The term deliberately avoids the message of unconditional certainty only in deference to the scientific maxim that one can never be absolutely positive unless everyone in the world was examined or the expert was an eye witness. The Board considers that a statement of absolute certainty such as “indeed, without a doubt,” is unprovable and reckless. Reasonable medical certainty represents the highest order of confidence in a comparison. It is, however, acceptable to state that there is “no doubt in my mind” or “in my opinion, the suspect is the biter” when such statements are prompted in testimony. In its most recent guidance (2016), the ABFO states that “[t]erms assuring unconditional identification of a perpetrator, or identification ‘without doubt,’ are not sanctioned as final conclusions in an open population case.”<sup>87,88</sup>

And, as the NRC noted, “There is continuing dispute over the value and scientific validity of comparing and identifying bite marks.”<sup>89</sup>



### 3.10.6.4 Fingerprints

#### ADMISSIBILITY

Courts have generally allowed fingerprint evidence.

#### DESCRIPTION/EXPLANATION OF THE SCIENCE

Fingerprint identification is based upon these premises: that the basic characteristics of fingerprints do not change with time, and that fingerprints are unique to an individual.<sup>90</sup> The validity of perfection has been established. The uniqueness of fingerprints has been accepted over time because of lack of contradiction and relentless repetition.

Collectively, the analysis of these prints is known as ‘friction ridge analysis,’ which consists of experience-based comparisons of the impressions left by the ridge structures of volar (hands and feet) surfaces.<sup>91</sup> Friction ridge analysis is an example of what the forensic science community uses as a method for assessing ‘individualization’—the conclusion that a piece of evidence (here, a pattern left by friction ridges) comes from a single unambiguous source.<sup>92</sup> Friction ridge analysis shares similarities with other experience-based methods of pattern recognition, such as those for footwear and tire impressions, tool marks, and handwriting analysis . . .<sup>93</sup>

But the basic assumption that everyone has a unique fingerprint from which they can be quickly identified through a computer database is flawed, experts have claimed.<sup>94</sup> Despite the widely held belief that fingerprint analysis is accurate, there are others that think ‘The time is ripe for the traditional forensic sciences to replace antiquated assumptions of uniqueness and perfection with more defensible empirical and probabilistic foundation.’<sup>95</sup>



Historically, friction ridge analysis has served as a valuable tool, both to identify the guilty and to exclude the innocent. Because of the amount of detail available in friction ridges, it seems plausible that a careful comparison of two impressions can accurately discern whether or not they had a common source.<sup>96</sup> Although there is limited information about the accuracy and reliability of friction ridge analyses, claims that these analyses have zero error rates are not scientifically plausible.<sup>97</sup>

### 3.10.7 Blood Pattern Evidence (aka Blood Spatter)

#### ADMISSIBILITY

The Texas Forensic Science Commission, a national leader in forensic science reform, has stated that the blood-spatter analysis used to convict a former Texas high school principal of murdering his wife in 1985 was “not accurate or scientifically supported” and the expert who testified was “entirely wrong.”<sup>98</sup>

The 2009 National Academy of Sciences study of forensic evidence stated, "In general, the opinions of bloodstain pattern analysis are more subjective than scientific . . . . Extra care must be given to the way in which the analyses are presented in court. The uncertainties associated with bloodstain pattern analysis are enormous."<sup>99</sup> The report concluded that those interpreting blood patterns in court proceedings should have, at minimum, an understanding of applied mathematics, the physics of fluid transfer and the pathology of wounds<sup>100</sup>

The 2016 PCAST report on *Forensic Science in Criminal Courts* addressed "cognitive bias" as a problem. "Cognitive bias" is the way in which human judgments are shaped by factors other than those relevant to the decision at hand. It includes "confirmation bias," where individuals interpret information, or look for new evidence, in ways that conform to their preexisting belief or assumption.<sup>101</sup> The report cited a study that showed fingerprint examiners can be influenced in their interpretations if they know what other forensic examiners already concluded. The study's authors recommended that those working in forensic labs have minimal exposure to other crime-scene evidence and things like confessions or eyewitness identifications.<sup>102</sup>



**DESCRIPTION/EXPLANATION OF THE SCIENCE**

Bloodstain patterns found at scenes can be complex, because although overlapping patterns may appear simple, in many cases their interpretations are difficult or impossible.<sup>103</sup> Workshops teach the fundamentals of basic pattern formation and are not a substitute for experience and experimentation when applying knowledge to crime reconstruction.<sup>104</sup> Such workshops are more aptly applicable for the investigator who needs to recognize the importance of these patterns so that he or she may enlist the services of a qualified expert.<sup>105</sup>

The Minnesota Bureau of Criminal Apprehension, in its description of forensic analysis disciplines, explains the usefulness of bloodstain pattern analysis in this way:

The recognition and analysis of bloodstain patterns can yield useful investigative information. The general role of the Bloodstain Pattern Analyst in a criminal investigation is to assist in the reconstruction of those events of an alleged incident that could have created the stains and stain patterns present at a crime scene, on items of physical evidence recovered from that scene and on items of clothing that were present at the crime scene . . . . The sizes of the individual stains composing a pattern, the shapes of these stains and their distribution relative to one another can be utilized for the purposes of determining how a particular stain or pattern may have been produced. Bloodstain pattern analysis evaluations are conducted to determine what action(s) or sequence of actions could have created the bloodstains and/or patterns observed. Information that may be gained with bloodstain pattern analysis include, for example, the position of the individual when the blood was deposited (sitting, standing, etc.), the relative position of individuals at the time of bloodshed, the possible type of weapon used as well as possible mechanisms that could have produced the blood staining on a surface.<sup>106</sup>

Scientific studies support some aspects of bloodstain pattern analysis. One can tell, for example, if the blood spattered quickly or slowly, but some experts extrapolate far beyond what can be supported. Although the trajectories of bullets are linear, the damage that they cause in soft tissue and the complex patterns that fluids make when exiting wounds are highly variable. For such situations, many experiments must be conducted to determine what characteristics of a bloodstain pattern are caused by particular actions during a crime and to inform the interpretation of those causal links and their variabilities. For these same reasons, extra care must be given to the way in which the analyses are presented in court. The uncertainties associated with bloodstain pattern analysis are enormous.<sup>107</sup>

### 3.10.8 Shaken Baby Syndrome (SBS)

#### ADMISSIBILITY

Courts have admitted expert testimony regarding the theory SBS as well as testimony criticizing its premise.<sup>108</sup> Federal Rule of Evidence 702 Advisory Committee Notes acknowledges that it may be proper to admit opposing scientific theories under *Daubert*.<sup>109</sup>

#### DESCRIPTION/EXPLANATION OF THE SCIENCE

The Mayo Clinic defines shaken baby syndrome—also known as abusive head trauma, shaken impact syndrome, inflicted head injury or whiplash shake syndrome—as “a serious brain injury resulting from forcefully shaking an infant or toddler.”<sup>110</sup>

*Many courts admit both expert testimony about Shaken Baby Syndrome and testimony criticizing the theory. That is permissible under FRE 702.*

Shaken baby syndrome destroys a child's brain cells and prevents his or her brain from getting enough oxygen. Shaken baby syndrome is a form of child abuse that can result in permanent brain damage or death.<sup>111</sup>



‘[T]he conclusions that are . . . reached [about shaken baby syndrome] . . . are for the most part anecdotal.’ Dr. Travis Hindman, a prosecution witness in *People v. Lind*, 718 N.E.2d 316, 324 (Ill. 1999). ‘Shaken baby syndrome [does] not exist. [It is] ‘the medical scandal of the last 20 years’.” Dr. John Plunkett, defense witness in *In re J.M.*, 2009 WL 1862523, at \*10 (Cal. Ct. App. 2009).<sup>112</sup>

As Professor Imwinkelried noted above, said,

. . . there was formerly a consensus, especially among pediatricians and pathologists, that violently shaking an infant can cause fatal brain injury. In many cases, the autopsy revealed such injuries, a caregiver acknowledged shaking the child, but there was no evidence that the child’s head had struck a surface or object.

Later, biomechanical experts conducted experiments with primates and anthropomorphic models of infant necks. The experiments suggested that shaking alone cannot generate enough force to cause fatal brain injury.

Nevertheless, in 2016 the Ninth Circuit Court of Appeals ruled that the biomechanical research had not invalidated the SBS theory to the extent that a defendant convicted on the basis of SBS was entitled to relief. In the court’s words, although the new research had prompted ‘a vigorous debate’ over SBS, the research did not discredit SBS to the same extent that [CBLA] has been exposed.

There are doubts about whether the biomechanical findings can be extrapolated to human infants. And further research is complicated by the fact that medical ethics precludes subjecting infants to violent shaking to test the premise.<sup>113</sup>

In synopsisizing Professor Imwinkelried’s article, Professor Kevin Cole of the University of San Diego School of Law wrote the following in his CrimProf Blog,



Although many articles have been written about the admissibility of SBS and its critiques, to date no article has addressed the question of the legal sufficiency of SBS testimony. The question is certainly now timely; in a trilogy of decisions dated 2007, 2010, and 2011, the Supreme Court reversed the Ninth Circuit which had thrice ruled the evidence in an SBS case legally insufficient to sustain a conviction. The question not only concerns SBS; it also raises the broader question of the scope of the Supreme Court's landmark 1979 legal sufficiency decision, *Jackson v. Virginia*. Some courts have read *Jackson* narrowly as contemplating that the judge conducting the sufficiency analysis will consider only the prosecution testimony. This article argues that *Jackson* mandates that the judge consider the defense testimony in the record as well as the prosecution evidence. In addition, the article contends that by restricting the judge's inquiry to the contents of learned treatises admissible under Federal Rule of Evidence 803(18), an expanded *Jackson* analysis can be conducted without usurping the jury's constitutional role under the Sixth Amendment. Finally, the article applies this mode of analysis to the SBS controversy and concludes that given the current state of the empirical record, standing alone SBS testimony is legally insufficient to prove causation.<sup>114</sup>

The criticism of "shaken baby syndrome" highlights the questions raised by the National Research Council of the National Academies, as well as the President's Council of Advisors on Science and Technology regarding the current state of forensic science and testimony from forensic experts. For the judiciary, these concerns must be considered in deciding whether to allow forensic testimony under FRE 702 and *Daubert/Frye* analysis and then, if the testimony is allowed, how much weight to give it and how far to let each expert go in providing their opinions.



### 3.10.9 A Sampling of Cases

#### FIREARMS / TOOL MARKS

*People v. Jones*, 34 N.E.3d 1065 (Ill. App. Ct. 2015), *vacated sub nom.* 2015 WL 13123108 (Ill. 2015). The “expert’s testimony lacked an adequate foundation where the expert testified that he found ‘sufficient agreement’ but did not testify to any facts that formed the bases or reasons for this ultimate opinion that the bullet matched defendant’s gun.”

*Clemons v. State*, 896 A.2d 1059 (Md. 2006). “The conclusory aspects of CBLA [comparative bullet lead analysis] are not generally accepted within the scientific community and thus are not admissible under the *Frye-Reed* standard for admitting scientific expert testimony.”

*State v. Raynor*, 189 A.3d 652 (Conn. App. Ct. 2018).

*In re Pers. Restraint of Trapp*, 165 Wash. App. 1003 (2011).

*Fowler v. State*, 194 A.3d 16 (Del. 2018).

*Parker v. State*, 2018 WL 1602585, (Miss. Ct. App. Apr. 3, 2018), *reh’g denied* (Sept. 4, 2018), *cert. granted*, 258 So. 3d 284 (Miss. 2018).

*State v. Allen*, 2017-0306 (La. Ct. App. 2017), *writ denied*, 2017-2180 (La. 2018), 253 So. 3d 798.

*Commonwealth v. Morales*, 2017 WL 1957754 (Pa. Super. Ct. 2017).

*Severance v. Commonwealth*, 799 S.E.2d 329 (Va. Ct. App. 2017), *aff’d*, 816 S.E.2d 277 (Va. 2018).

Com. v. Urritia, 2015 WL 7721897 (Pa. Super. Ct. 2015).

State v. Sisneros, 314 P.3d 665 (N.M. 2013).

People v. Blacknell, 2015 WL 6157479 (Cal. Ct. App. 2015).

People v. Picasso, 2017 WL 4857013 (Cal. Ct. App. 2017), *reh'g denied* (Nov. 9, 2017), *review denied* (CA. 2018).

People v. Hoskins, 2017 WL 3090592 (Mich. Ct. App. 2017).

State v. Cox, 779 N.W.2d 844 (Minn. 2010).

Moody v. State, 2017 WL 829820, (Tenn. Crim. App. 2017), *appeal denied* (June 9, 2017).

State v. Shine, 113 N.E.3d 160 (Ohio Ct. App. 2018).

Lewis v. State, 2014 WL 7204708 (Tex. Crim. App. 2014).

#### **QUESTIONED DOCUMENTS (INCLUDING HANDWRITING, INK, INK MARKS)**

State v. Clifford, 121 P.3d 489 (Mont. 2005). Rule of evidence did not require trial court to hold *Daubert* hearing before admitting testimony of handwriting expert.

Riley v. State, 102 N.E.3d 353 (Ind. Ct. App. 2018), *transfer denied*, 110 N.E.3d 1147 (Ind. 2018).

State v. Livanos, 725 P.2d 505 (Ariz. Ct. App. 1986). “Practical training and experience” alone are not enough to clearly qualify as an expert regarding questioned documents.



Carroll v. State, 634 S.W.2d 99 (Ark. 1982). “Practical training and experience” alone are not enough to clearly qualify as an expert regarding questioned documents.

Tomlin v. Commonwealth, 2017 WL 972169 (Va. Ct. App. 2017).

State v. Green, 2017 WL 2535899 (N.J. Super. Ct. App. Div. 2017).

Pettus v. United States, 37 A.3d 213 (D.C. 2012).

Hooten v. State, 492 So. 2d 948 (Miss. 1986).

Cooper v. State, 174 P.3d 726 (Wyo. 2008).

Commonwealth v. Ramsey, 2016 WL 5790757 (Pa. Super. Ct. 2016).

Mitchell v. Madison Cty. Sheriff's Dep't, 325 S.W.3d 603 (Tenn. Ct. App. 2010).

Forreston State Bank v. Diehl, 2015 IL App (2d) 150384-U (Ill. Ct. App. 2015).

Virgin Islands v. Todmann, 2010 WL 684009 (V.I. 2010).

#### TRACE EVIDENCE

State v. Gissendanner, 2015 WL 6443194 (Ala. Crim. App. 2015), *rev'd in part sub nom.* Ex parte Gissendanner, 2019 WL 101611 (Ala. 2019).

State v. McGuire, 16 A.3d 411 (N.J. App. Div. 2011).

People v. Escort, 91 N.E.3d 483 (Ill. Ct. App. 2017).



Boyd v. State, 200 So.3d 685 (Fla., 2015).

State v. Blevins, 2018 WL 4265513 (Ohio Ct. App. 2018) *appeal not allowed*, 114 N.E.3d 215 (Ohio 2018).

Molina v. State, 2011 WL 5398174 (Tex. Crim. App. 2011).

State v. Jones, 749 S.W.2d 356 (Mo. 1988).

### **BIOLOGICAL/SEROLOGY SCREENING (HAIR, FINGERNAILS, BLOOD TYPE, ETC.)**

People v. Reilly, 196 Cal.App.3d 1127 (Cal. Ct. App. 1987). “. . . electrophoretic testing of dried bloodstain evidence is generally accepted as reliable in the relevant scientific community.”

Funderburk v. Com., 368 S.E.2d 290 (Va. 1988). Testimony of the forensic serologist concerning “. . . statistical prevalence in the general population of persons possessing victim's blood . . .” characteristics was properly admitted.

Graham v. State, 308 S.E.2d 413 (Ga. Ct. App. 1983). Testimony of expert witness on identification of blood samples based on procedure known as electrophoresis, “. . . concerning statistical or mathematical probability of certain enzymes being found in the blood of the general population . . .” was properly admitted.

People v. Seda, 529 N.Y.S.2d 931 (N.Y. Sup. Ct. 1988). “This court concludes that the 4-in-1 system [of electrophoresis] employed here has not gained general acceptance in the scientific community.”

State v. Dirk, 364 N.W.2d 117 (S.D. 1985). Trial court did not abuse its discretion in admitting expert testimony and test results concerning enzyme analysis of the blood.



*State v. Ferguson*, 54 So.3d 152 (La. Ct. App. 2010). Retired criminalist was properly accepted as expert in serology in murder prosecution. “He worked for the NOPD for thirty-two years with twelve of those years served in the crime lab performing serology testing. His education included receiving a Bachelor of Science degree in biological science from Louisiana State University in 1965 and a Master of Arts degree in marine biology from California State University in 1968. He had previously been qualified as an expert in serology in other sections of Criminal District Court.”

### HAIR ANALYSIS

*Commonwealth v. Chmiel*, 173 A.3d 617 (Penn. 2017). Court granted post-conviction relief in part based upon hair analysis testimony which exceeded the limits of science and overstated to the jury the significance of microscopic hair analysis. “The FBI now has publicly repudiated the use of microscopic hair analysis to ‘link a criminal defendant to a crime.’”

*Johnson v. State*, 2016 WL 7176765 (Fla. 2016).

*Duckett v. State*, 231 So.3d 393 (Fla. 2017).

*Partin v. Com.*, 337 S.W.3d 639 (Ky. Ct. App. 2010). State police forensic examiner testified certain hair was similar to the victim’s hair, while further testifying other was dissimilar to the victim’s hair.

*Richardson v. Superior Court*, 183 P.3d 1199 (Cal. 2008). The prosecution’s second expert, Morton, acknowledged the limits of hair analysis on “cross-examination when he testified that the most that could be said about a hair sample was that it was ‘consistent’ with an individual’s hair and ‘could be from that individual.’”

*Imperial Cty. Dep’t of Soc. Servs. v. J.M. (In re J.M.)* 2018 WL 1442488 (Cal. Ct. App. 2018). “In this case of apparent

first impression in California, we hold that the Imperial County Department of Social Services (Department) failed to meet its burden under *People v. Kelly* [citation] of showing that testing hair for marijuana and methamphetamine has gained general acceptance in the scientific community.”

U.S. Brown, 557 F.2d 541 (1977). “After extensive review of the record, we are inclined to agree with Appellant that the Government failed to fulfill the threshold requirement of demonstrating that ion microprobe analysis is a generally accepted procedure for comparing samples of human hair and that the experiments conducted by their experts carry sufficient indicia of reliability and accuracy to be said to cross “the line between the experimental and demonstrable stages.”

#### FOOTWEAR

Rodriguez v. State, 30 A.3d 764 (Del. 2011). Trial court did not abuse its discretion in prosecution for arson and other offenses in finding that latent fingerprint examiner qualified as an expert in tire track and shoe print analyses. “Here, the record shows that Hegman participated in an FBI course of instruction that covered tire track and shoeprint analysis, independently studied a leading treatise on the discipline, and previously testified on the analysis of tire tracks and shoeprints in Delaware courts. Hegman also demonstrated knowledge of the variables that could affect impressions, including the type of surface and degree of tire inflation.”

State v. Brewczynski, 294 P.3d 825 (Wash. Ct. App. 2013). Trial court did not abuse its discretion in admitting witness's expert testimony about footwear impression evidence in murder case; witness qualified as an expert due to his training and experience, his testimony was helpful to the jury, footwear analysis was generally accepted in the forensic community, and witness's methodology was a question of weight for the jury, rather than an issue of admissibility.



State v. Patel, 2016 WL 8135385 (Conn. Super. Ct. 2016). “Ms. Ragaza testified that, in her opinion, footwear comparison analysis is generally accepted in the relevant scientific community.”

State v. Jones, 681 S.E.2d 580 (S.C. 2009). “Based on our decision in *Jones I* and the lack of any subsequent research developments which would validate ‘barefoot insole impression’ evidence, we find the trial judge erred in denying Jones’s motion to suppress this evidence. . . . we find the evolution of this evidence post-*Jones I* has not deemed it scientifically reliable.”

State v. Gay, 145 A.3d 1066 (N.H. 2016). “We conclude, therefore, that expert testimony on this issue [Footwear Impressions] satisfied the purpose of Rule 702 by providing evidence that could ‘assist the trier of fact to understand the evidence or to determine a fact in issue.’ N.H. R. Ev. 702.”

State v. Thurber, 420 P.3d 389 (Kan. 2018). A “forensic scientist, testified he took photographs and casts of ‘footwear impressions’ at the Kaw Wildlife Area” and testified “the impressions along the path were consistent with footwear worn” by the defendant and victim.

#### FINGERPRINTS

U.S. v. Crisp, 324 F.3d 261 (4th Cir. 2003). “While Crisp may be correct that further research, more searching scholarly review, and the development of even more consistent professional standards is desirable, he has offered us no reason to reject outright a form of evidence that has so ably withstood the test of time . . . . Ultimately, we conclude that while further research into fingerprint analysis would be welcome, ‘to postpone present in-court utilization of this bedrock forensic identifier pending such research would be to make the best the enemy of the good.’”



## TIRE IMPRESSIONS, ETC.

Rodriguez v. State, 30 A.3d 764 (Del. 2011). Trial court did not abuse its discretion in prosecution for arson and other offenses in finding that latent fingerprint examiner qualified as an expert in tire track and shoe print analyses. “Here, the record shows that Hegman participated in an FBI course of instruction that covered tire track and shoeprint analysis, independently studied a leading treatise on the discipline, and previously testified on the analysis of tire tracks and shoeprints in Delaware courts. Hegman also demonstrated knowledge of the variables that could affect impressions, including the type of surface and degree of tire inflation.”

Anderson v. State, 220 So.3d 1133 (Fla. 2017). There is no requirement that a witness be “certified” in a particular field in order to be deemed an expert and allowed to give opinion testimony. [The witness’] specialized knowledge, training, and extensive experience were sufficient for the trial court to qualify him as an expert on Tire Impression evidence.

In re Norman, 2015 WL 5943643 (N.J. Super. Ct. App. Div. 2015). “Crime scene investigators went to the lot identified by A.F. where they observed tire impressions, boot impressions, and they found a broom stick or pole. Forensic analysis proved that the tire impressions were consistent with tires on the police car driven by Ingram . . . . The Commission accepted the forensic evidence, including the tire impressions, boot impressions, and pole with fibers matching fibers from A.F.'s sweatshirt, as corroborating A.F.'s testimony. A fact finder is not to give greater or lesser weight to the testimony of a police officer merely because of his or her status as a police officer and the Commission was critical of the ALJ's attributing credibility to appellant based, in part, on his status as a police officer.”



**BITEMARKS**

*Coronado v. State*, 384 S.W.3d 919 (Tex. Ct. Crim. App. 2012). Court cannot conclude the trial court abused its discretion in admitting the testimony of expert in forensic dentistry concerning bite mark analysis was admissible in prosecution for injury to a child.

*Howard v. State*, 701 So. 2d 274 (Miss. 1997). “This Court has never ruled directly on the admissibility or reliability of bite-mark identification evidence, though it has addressed cases in which bite-mark evidence was an issue. . . . While few courts have refused to allow some form of bite-mark comparison evidence, numerous scholarly authorities have criticized the reliability of this method of identifying a suspect. . . . There is little consensus in the scientific community on the number of points which must match before any positive identification can be announced. . . . Because the opinions concerning the methods of comparison employed in a particular case may differ, it is certainly open to defense counsel to attack the qualifications of the expert, the methods and data used to compare the bite marks to persons other than the defendant, and the factual and logical bases of the expert’s opinions. Also, where such expert testimony is allowed by the trial court, it should be open to the defendant to present evidence challenging the reliability of the field of bite-mark comparisons. . . . Only then will the jury be able to give the proper weight, if any, to this evidence.”

*Meadows v. Com.*, 178 S.W.3d 527 (Ky. Ct. App. 2005). “Dr. Smock gave his expert opinion that the physical findings were consistent with Meadows’s account of suffering a bite to the penis. . . . Dr. Smock did not attempt to identify who made the bite based on the bite mark. He conceded that he could not determine whether the bite was intentional or accidental based upon the appearance of the bite mark. Regarding the force used, he could only say that a considerable amount of force would be required to break the skin and damage the blood vessels in the urethra.”

## **BLOOD PATTERN EVIDENCE (AKA BLOOD SPATTER)**

Jones v. State, 918 So.2d 1220 (Miss. 2005). Trial court did not abuse its discretion by admitting expert's opinion testimony concerning blood pattern on murder defendant's shirt.

Commonwealth v. Merry, 453 Mass. 653, 667 n. 13 (2009). An expert on blood spatter was not necessary for prosecutor to argue how defendant's blood got on air bag because jury could draw own conclusions about source of blood.

People v. Ramos, 388 P.3d 888 (Colo. 2017). “[A]n ordinary person would not be able to testify reliably about the difference between blood cast-off and blood transfer. Therefore, we affirm the court of appeals’ holding that the trial court abused its discretion by not qualifying a police detective’s blood testimony as expert testimony.”

Hudson v. State, 146 S.W.3d 380 (Ark. Ct. App. 2004). Police officer's “testimony established that he had received extensive training and education in blood-spatter analysis, as well as experience in conducting this analysis at crime scenes. It was also established that blood-spatter analysis was a well-recognized science, which has been in existence for many years . . . . In fact, [the officer] testified that he had previously been certified by a trial court in this state as an expert and had testified regarding blood-pattern analysis.”

Simpson v. Com., 2013 WL 5988567 (Va. Ct. App. 2013). “The testimony concerning the blood spatter evidence involved a matter beyond the scope or knowledge of the average juror and was a topic within the peculiar knowledge, science, and skill of the expert witness. Indeed, the Supreme Court has stated that blood spatter analysis “involves the application of principles of physics, chemistry, biology, and mathematics.”



Johnson v. State, 2018 WL 3359559 (Md. Ct. Spec. App. 2018)  
 “O'Dell used the generally accepted scientific technique of bloodstain pattern analysis to examine bloodstain patterns on Johnson's clothes and determine from that analysis whether the blood on Johnson's clothes could have resulted from his supposed interactions with a man away from the crime scene. The fact that another expert witness disagreed about the results of O'Dell's analysis did not create a *Frye-Reed* issue.”

People v. Lyons, 2017 IL App (1st) 141334-U (2017), *appeal denied*, 93 N.E.3d 1070 (Ill. 2017). The testimony of the State's blood spatter expert was not required to be excluded when a proper foundation was laid for his testimony.

### SHAKEN BABY SYNDROME (SBS)

People v. Snell, 2011 WL 10088352 (Ill. Ct. App. 2011). “We acknowledge defendant's argument that no Illinois reviewing court has ever determined that shaken baby syndrome satisfies *Frye* . . . . Indeed, defendant does not cite, and our research has not revealed, any Illinois decisions that hold that shaken-baby syndrome evidence is not generally accepted . . . . We also note that for some time, courts in other states have found shaken baby syndrome to be a generally accepted diagnosis in the medical community”

McDonald v. State, 101 So. 3d 914, 915 (Fla. Dist. Ct. App. 2012). Trial court's error in denying indigent defendant's motion for appointment of expensive out-of-state expert witness without exploring less expensive options was not harmless in prosecution for simple child abuse involving shaken baby syndrome. “Interestingly, this is one area in the law where the science is used to prove all elements of the crime. In many cases it comes down to science and nothing more than that. . . . And, it appears that in the relevant



scientific community there are some experts who question the hypotheses underlying opinions similar to those presented by the State from its four experts in this case.”

*Com. v. Millien*, 50 N.E.3d 808 (Mass. 2016). Defense counsel was ineffective for not requesting funds for expert witness. “Therefore, had Dr. Uscinski’s expert testimony been offered at trial, the defendant could have challenged Dr. Newton’s opinion as to the cause of Jahanna’s head injuries.”

*State v. Saavedra Ruiz*, 197 Wash. App. 1015 (2016). “Although the expert medical testimony presented in Saavedra Ruiz’s trial linked symptoms of Natalie’s brain injuries with shaken baby syndrome, it is clear from the record that the State did not allege that a shaking event caused her death. Unlike the victim in *Fero*, Natalie suffered a skull fracture. Here, Dr. Clark testified that Natalie’s death was caused by blunt force trauma to the back of her head.”



## 3.10.10 Endnotes

- 1 NAT'L RESEARCH COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 4 (2009), <http://www.nap.edu/catalog/12589.html>
- 2 *Id.*
- 3 *Id.*
- 4 Laura Tierney, *Analysis, Comparison, Evaluation, and Verification* (ACE-V), in ENCYCLOPEDIA OF FORENSIC SCIENCES (2013)
- 5 R.A. HUBER, A.M. HEADRICK, HANDWRITING IDENTIFICATION AND FACTS AND FUNDAMENTALS, (CRC Press, 1999).
- 6 R.A. Huber, *Expert witnesses*, CRIM. LAW Q. 2 (1959) 276–295; R.A. Huber, *The philosophy of identification*, RCMP GAZETTE (1972) 9–14.
- 7 DAVID R. ASHBAUGH, QUANTITATIVE-QUALITATIVE FRICTION RIDGE ANALYSIS, (1999)
- 8 REPORT TO THE PRESIDENT: FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS at 3. (September 2016). [https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_forensic\\_science\\_report\\_final.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf)
- 9 NAT'L RESEARCH COUNCIL, *supra* note 1.
- 10 John Butler, *U.S. initiatives to strengthen forensic science & international standards in forensic DNA*, 18 FORENSIC SCI. INT. GENET. 4 (2015).
- 11 U.S. Dep't. J., Office of the Att'y Gen., Memorandum for Heads of Department Components, Recommendations of the National Commission on Forensic Science, (September 6, 2016), <https://www.justice.gov/opa/file/891366/download>
- 12 Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993).
- 13 NAT'L RESEARCH COUNCIL, *supra* at 1.
- 14 REPORT TO THE PRESIDENT, *supra* at 8.
- 15 *Id.*

- 16 Lauren J. Young, *The Flaws In Forensic Science*, SCIENCE FRIDAY, May 30, 2017, <https://www.sciencefriday.com/articles/the-flaws-in-forensic-science/>.
- 17 REPORT TO THE PRESIDENT, *supra* at 8.
- 18 Examiners can also undertake other kinds of analysis, such as for distance determinations, operability of firearms, and serial number restorations as well as the analyze primer residue to determine whether someone recently handled a weapon. Also, for more complete descriptions, *see, e.g.*, NAT'L RESEARCH COUNCIL, *supra* note 1; IS A MATCH REALLY A MATCH? A PRIMER ON THE PROCEDURES AND VALIDITY OF FIREARM AND TOOLMARK IDENTIFICATION, FED. BUREAU INVESTIGATION, archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/july2009/review/2009\_07\_review01.htm (last visited April 14, 2019).
- 19 *Id.*
- 20 NAT'L RESEARCH COUNCIL, BALLISTIC IMAGING 3-4 (Nat'l Acad. Press. 2008).
- 21 REPORT TO THE PRESIDENT, *supra* note 8 at 105.
- 22 J. Song, et. al., *Estimating error rates for firearm evidence identifications in forensic science*, FORENSIC SCI. INT'L., 13 December 2017.
- 23 FED. R. EVID. 702; Jeremy Dack, *Using Forensic Ballistics in The Courtroom* 637 SETON HALL L. SCHOOL STUDENT SCHOLARSHIP at 5 (2014). [https://scholarship.shu.edu/student\\_scholarship/637](https://scholarship.shu.edu/student_scholarship/637)
- 24 NAT'L RESEARCH COUNCIL, *supra* note 1, at 150-152.
- 25 Nancy Ritter, *The Science Behind Firearm and Tool Mark Examination*, 274 NAT'L INST. JUST. J. 20 (2014), <https://www.nij.gov/journals/274/Pages/firearm-toolmark-examination.aspx>
- 26 *Id.*
- 27 *Id.*
- 28 *Id.*
- 29 Dack, *supra* note 23 at 6
- 30 *Id.*, at 7-8.



- 31 REPORT TO THE PRESIDENT, *supra* note 8 at 111.
- 32 Edward Imwinkelried & William Tobin, *Comparative Bullet Lead Analysis (CBLA) Evidence: Valid Inference or Ipse Dixit?*, 28 OKLA. CITY U. L. REV. 43 (2003); Erik Randich et al., *A Metallurgical Review of the Interpretation of Bullet Lead Compositional Analysis*, 127 FORENSIC SCI. INT'L 174 (2002) (Tobin was a coauthor); William Tobin & Wayne Duerfeldt, *How Probative is Comparative Bullet Lead Analysis?*, 17 CRIM. JUST. 26 (Fall 2002); Paul Giannelli, *Comparative Bullet Lead Analysis: A Retrospective*, CASE WEST. RESERVE U. SCHOOL L. FACULTY PUB. (2010), [https://scholarlycommons.law.case.edu/faculty\\_publications/97](https://scholarlycommons.law.case.edu/faculty_publications/97).
- 33 *Id.*
- 34 *Id.*
- 35 *Id.*
- 36 *Id.*
- 37 Edward Imwinkelried, *When New Research Proves Courtroom 'Experts' Wrong*, CRIME REP. (July 28, 2017). <https://thecrimereport.org/2017/07/28/when-new-research-proves-courtroom-experts-wrong/>
- 38 Michael Risinger, *Cases Involving the Reliability of Handwriting Identification Expertise Since the Decision in Daubert*, 42 TULSA L. REV. (Winter 2007), <http://digitalcommons.law.utulsa.edu/tlr/vol43/iss2/11>
- 39 NAT'L RESEARCH COUNCIL, *supra* note 1, at 163-167, citing *Standard Descriptions of Scope of Work Relating to Forensic Document Examiners* (American Society for Testing and Materials [ASTM] Designation E 444 -98) (1998), *Standard Guide for Test Methods for Forensic Writing Ink Comparison* (ASTM Designation E 1422 -01) (2001), *Standard Guide for Writing Ink Identification* (ASTM Designation E 1789 -04) (2004), and *Standard Guide for Examination of Handwritten Items* (ASTM Designation E 229 0-03) (2003).
- 40 *Id.*
- 41 M. Kam, et al., *Writer identification by professional document examiners* 42 J. FORENSIC SCI. 778 (1997), reports on proficiency tests given to more than 100 questioned document examiners and to a control group of individuals with similar educational backgrounds. Each subject made 144 pair-wise comparisons. Although

the study showed that document examiners are much more accurate than lay people in determining whether or not two samples “match” (based on the “identification” and “strong probability” definitions of ASTM standard E1658), professionals nonetheless declared an erroneous match in 6.5 percent of the comparisons. A similar, more recent study, focusing on whether individual signatures were genuine, is reported in J. Sita, et al., *Forensic handwriting examiners’ expertise for signature comparison*. 47 J. FORENSIC SCI. 1117 (2002). That study found that professional handwriting examiners erred in 3.4 percent of their judgments.

- 42 NAT’L RESEARCH COUNCIL, *supra* note 1, at 167.
- 43 M. MERLINO NAT’L INST. JUST., U.S. DEPT. JUST., VALIDITY, RELIABILITY, ACCURACY AND BIAS IN FORENSIC SIGNATURE IDENTIFICATION (2015).
- 44 C. Roux, et al., *The end of the (forensic science) world as we know it? The example of trace evidence*, 370 PHIL. TRANS. R. SOC. (2015). <http://dx.doi.org/10.1098/rstb.2014.0260>.
- 45 J. Robertson & C. Roux, *Trace evidence: here today, gone tomorrow?* 50 SCI. JUST. 18 (2009).
- 46 D. Hazard & P. Margot, *Forensic Science Culture* in ENCYCLOPEDIA OF CRIMINOLOGY & CRIM. JUST., at 1782–1795 (G. Bruinsma G. & D. Weisburd eds., Springer 2014).
- 47 C. Roux, et. al., *From forensics to forensic science*, 24 CURR. ISSUES CRIM. J. 7 (2012); NAT’L RESEARCH COUNCIL, *supra* note 1.
- 48 C. Roux, *supra* note 65.
- 49 FORENSIC RESOURCES, NORTH CAROLINA OFFICE OF INDIGENT DEFENSE SERVICES, <http://www.ncids.com/forensic/serology/serology.shtml> (last visited April 14, 2019).
- 50 NAT’L RESEARCH COUNCIL, *supra* note 1, at 128-133.
- 51 *Id.*
- 52 *Id.*
- 53 Imwinkelried, *supra* note 37.
- 54 NAT’L RESEARCH COUNCIL, *supra* note 1 at 47.





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- 56 *Id.*
- 57 *Id.*
- 58 See also DJ McAneny, *Delaware DOJ announces review of convictions on the back of faulty hair evidence analysis method before 2000*, WDEL, (March 4, 2019), (Delaware Department of Justice announcement of independent review of criminal convictions obtained prior to the year 2000 on the back of a "highly unreliable" hair comparison analysis method resulting in "potentially questionable hair evidence" used in those cases). [https://www.wdel.com/news/delaware-doj-announces-review-of-convictions-on-the-back-of/article\\_f8eb80b0-3eb6-11e9-8adf-f790de5bca08.html?fbclid=IwAR2hWZCtHhgUIJW1orCGc90FtU9S\\_pZxb4R-8SJ1u\\_0n6VOcjayW6I6ovtI](https://www.wdel.com/news/delaware-doj-announces-review-of-convictions-on-the-back-of/article_f8eb80b0-3eb6-11e9-8adf-f790de5bca08.html?fbclid=IwAR2hWZCtHhgUIJW1orCGc90FtU9S_pZxb4R-8SJ1u_0n6VOcjayW6I6ovtI)
- 59 NAT'L RESEARCH COUNCIL, *supra* note 1 at 155-161.
- 60 *Id.*
- 61 SEE DEPT. J. PROPOSED UNIFORM LANGUAGE FOR TESTIMONY AND REPORTS FOR THE FORENSIC HAIR EXAMINATION DISCIPLINE, [www.justice.gov/dag/file/877736/download](http://www.justice.gov/dag/file/877736/download) and SUPPORTING DOCUMENTATION FOR DEPT. J. PROPOSED UNIFORM LANGUAGE FOR TESTIMONY & REPORTS FOR THE FORENSIC HAIR EXAMINATION DISCIPLINE, [www.justice.gov/dag/file/877741/download](http://www.justice.gov/dag/file/877741/download).
- 62 REPORT TO THE PRESIDENT, *supra* note 8 at 121.
- 63 *Id.*
- 64 REPORT TO THE PRESIDENT, *supra* note 8 at 121-122.
- 65 *Id.*
- 66 See SWGTREAD RANGE OF CONCLUSIONS STANDARDS FOR FOOTWEAR AND TIRE IMPRESSION EXAMINATIONS (2013). SWGTREAD GUIDE FOR THE EXAMINATION OF FOOTWEAR AND TIRE IMPRESSION EVIDENCE (2006) and BODZIAK, FOOTWEAR IMPRESSION EVIDENCE: DETECTION, RECOVERY, AND EXAMINATION 347 (2nd ed. 2000).
- 67 REPORT TO THE PRESIDENT, *supra* note 8 at 114-117

- 68 *Id.*
- 69 REPORT TO THE PRESIDENT, *supra* note 8 at 116.
- 70 REPORT TO THE PRESIDENT, *supra* note 8 at 117.
- 71 *Id.*
- 72 *Id.*
- 73 *Id.*
- 74 Alex Nabaum, et al., *Bad science puts innocent people in jail — and keeps them there*, WASH. POST, March 21, 2016. [https://www.washingtonpost.com/outlook/bad-science-puts-innocent-people-in-jail--and-keeps-them-there/2018/03/20/f1fffd08-263e-11e8-b79d-f3d931db7f68\\_story.html?utm\\_term=.e3603e4286a7](https://www.washingtonpost.com/outlook/bad-science-puts-innocent-people-in-jail--and-keeps-them-there/2018/03/20/f1fffd08-263e-11e8-b79d-f3d931db7f68_story.html?utm_term=.e3603e4286a7)
- 75 *People v. Marx*, 54 Cal. App. 3d 101 (1975).
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An abstract graphic featuring teal wireframe lines that form a series of overlapping, flowing loops. Scattered throughout the background are small, light-colored numbers (0-9).

# 3. SCIENTIFIC EVIDENCE

## Section 3.11 Forensic Analytical Evidence

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**HON. KEVIN BURKE (RET.)**

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### 3.11.1 Introduction

Forensic science is the application of scientific knowledge to legal problems in trials, civil disputes, and arbitration proceedings. Many forensic science disciplines have physical, chemical, and biochemical principles at their core. This includes drug identification chemistry, forensic toxicology, and several types of trace evidence analyses. There are computer innovations which have greatly increased the capability and accuracy of forensic analytical analysis, but at its core, there is an element of human judgment.

Forensic analysis of most physical and biological evidence is conducted for two purposes: identification and comparison. Identification determines what exactly a particular item or substance is. Is that green leafy substance marijuana or oregano? Is that brown stain dried blood of a human being or an animal? A forensic examiner may offer an opinion that the substance in question is present, not present, or that testing was inconclusive, and the presence of the substance cannot be ruled in or ruled out. Comparisons are made to find out whether a known and a suspect item or substance share a common origin. Did the fingerprint, hair, or blood come from the suspect? Does the paint smudge found on a hit-and-run victim's clothing match that of the suspect's car?

Paul Kirk, in an early treatise on forensic science, *Crime Investigation*, wrote:

Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as relevant evidence against him. Not only his fingerprints or his footprints, but his hair, the fibers from his clothes, the glass he breaks, the tool marks he leaves, the paint he scratches, the blood or semen he deposits or collects – all those bear mute witness against him. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong; it cannot perjure itself; it cannot be wholly absent. Only its misinterpretation can err. Only human failure to find it, study and understand it can diminish its value.<sup>1</sup>

There are few rules of thumb for judges, except one: Every field of forensic science has potential problems. Although infrequent, there are examples of rogue forensic examiners.<sup>2</sup> The American Society of Crime Lab Directors' Laboratory Accreditation Board candidly said, "Forensic scientists are human beings. As such they will sometimes make mistakes and, in some very rare instances, push the boundaries of ethical behavior."<sup>3</sup> Recent court decisions are forcing forensic scientists to improve both the science upon which the technology is based and the competence of expert witnesses in forensic science. Because of the many changes and improvements in the field, the adage "every once in a while, we should hang a question mark after things we take for granted" applies to a judge who must make a decision with forensic analytical evidence.

The qualifications of the forensic scientist are crucial. The more the particular type of forensic analysis is founded on medical research, the more trustworthy the analysis. For example, blood analysis dominates medicine. It is likely every judge has at one point in their life had lab work ordered by their doctor—few have had a personal experience with blood spatter pattern evidence.

The RAND Forensic Technology Survey<sup>4</sup> study found that there is a pressing need for more and better forensic science technology—and for well-trained people to use it and present its results. Many crime laboratories have substantial backlogs of evidence not yet tested or otherwise processed. Clearing these backlogs is a major concern and goal of laboratory directors. The RAND Forensics Survey found that more than half of the forensic lab workload was for tests of controlled substances, about a sixth was for latent prints, and a ninth was for blood alcohol tests.

*Recent court decisions are forcing forensic scientists to improve both the science upon which the technology is based and the competence of expert witnesses in forensic science.*

There are several highly reputable professional associations of forensic analysts. The American Academy of Forensic Sciences, for example, is a multidisciplinary professional organization that provides leadership to advance science and its application to the legal system. The objectives of the Academy are to promote

professionalism, integrity, competency, education, foster research, improve practice, and encourage collaboration in the forensic sciences. However, only a small number of forensic experts are members of the American Academy of Forensic Sciences.

### 3.11.2 Toxicology

Toxicology is the study of the effects that chemicals, such as drugs, and other substances can have. Toxicology is part chemistry, part biology, and a large part medical research. Every substance can induce some form of toxic effect. The type and nature of effects will vary depending on the dose (amount of substance that finds its way into the body), route of administration (i.e., oral, inhalation, skin, injection), duration (days, weeks, months, years), and frequency (how many times per day, week, month, year) of exposure. Properly done, examining samples of blood, urine, other bodily fluid, or tissue samples can determine whether or not an individual has used, or is currently under the influence of, a wide variety of substances.

Typically, a toxicology report will include a list of samples being tested (e.g., hair, urine, blood), the methods used for testing the samples, the patient data (including any relevant medical information such as medical conditions or prescribed medication), laboratory results which indicate which drug or chemical was tested for and whether or not the drug or chemical was present in the given toxicology sample (these results are often presented in a table or graph format), and an explanation—in simple and clear terms—that analyzes the outcomes of the findings. The nomenclature of many of these reports can be difficult for judges and juries to understand.

Pathways are the means by which an environmental chemical may reach an exposed person. Chemicals can enter the body by four fundamental routes: (1) oral exposure (e.g., ingestion of the toxic substance directly, or in food or drinking water); (2) insufflation or inhalation (e.g., breathing air or inhaling dust contaminated with the toxic substance); (3) direct contact with the skin (e.g., spilling of a pesticide mixture on the body); or (4) by direct injection into the body (e.g., introduction of a drug by intravenous injection).



Xenobiotics are substances which are foreign to human beings. Xenobiotics include therapeutic medication, alcohol and other drugs, pesticides, toxins, and other poisons. The period of detection of a xenobiotic, or its metabolite from the last exposure to the time that it is last detectable in a specimen, is critical. For example, the period of detection of alcohol in a urine sample is 7–12 hours and 1–30 days for cannabinoids. Toxicants are classified into six groups (See Table 3.11.1) based on their physical and chemical characteristics and the manner by which they are extracted (isolated) from biological fluids and tissues for analysis.

### CLASSIFICATION OF TOXICANTS BASED ON PHYSICOCHEMICAL PROPERTIES<sup>5</sup>

Class of Toxicant	Examples
Toxic gases or vapors	Carbon monoxide, hydrogen sulphide, diethyl ether, chloroform
Volatile liquid poisons	Benzene, toluene, aromatic hydrocarbons, glycols, aldehydes, essential oils of some plants
Acids and strong bases	Hydrochloric or sulphuric acid, sodium or potassium hydroxide
Inorganic anions	Permanganates, chromates
Metals or salts of heavy metals	Arsenic, mercury, lead
Acids, basic or neutral non-volatile organic chemicals and drugs	Most synthetic drugs, alkaloids, illicit drugs, insecticides.

TABLE 3.11.1

## APPLICATIONS OF FORENSIC TOXICOLOGY<sup>6</sup>

Sub-discipline	Purpose	Applications	Toxicants Analyzed
Postmortem toxicology	Evaluate contributing factors, cause and manner of death	<ul style="list-style-type: none"> <li>• Suspected drug intoxication or overdose</li> <li>• Suspected poison- or drug-related death</li> </ul>	<ul style="list-style-type: none"> <li>• Drugs and their metabolites</li> <li>• Ethanol, toluene and other volatile substances</li> <li>• Carbon monoxide and other gases</li> <li>• Metals</li> <li>• Other toxic chemicals in human fluids and tissues</li> </ul>
Human performance toxicology	Evaluate effect or impairment of human performance or behavior	<ul style="list-style-type: none"> <li>• Drug-facilitated assault, rape or other crime</li> <li>• Suspected driving under the influence of alcohol or other drugs</li> </ul>	<ul style="list-style-type: none"> <li>• Drugs in their metabolites</li> <li>• Alcohol (ethanol) and other drugs</li> <li>• Chemicals in blood, breath or other biological specimens</li> </ul>



**APPLICATIONS OF FORENSIC TOXICOLOGY<sup>6</sup>**

Sub-discipline	Purpose	Applications	Toxicants Analyzed
Doping control	Protect the health of athletes, maintain fair competitive standards, and prevent wagering fraud	<ul style="list-style-type: none"> <li>• Use of performance-enhancing drugs in human and animal sports</li> </ul>	<ul style="list-style-type: none"> <li>• Performance-enhancing drugs</li> <li>• Banned substances such as stimulants, anabolic steroids and diuretics in blood or urine</li> </ul>
Forensic drug testing	Evaluate prior use or abuse	<ul style="list-style-type: none"> <li>• Use of performance-enhancing drugs in human and animal sports</li> </ul>	<ul style="list-style-type: none"> <li>• Drugs and their metabolites in urine</li> </ul>

TABLE 3.11.2

**What Can Go Wrong with A Toxicology Analysis?**

1. Problems with sample collection, transport and storage;
2. Problems with analytical methods used (for example, random sampling is an approach in which labs test only a portion of confiscated drugs. But some state courts, such as Minnesota, disfavor random testing);<sup>7</sup>
3. The nature of the substance(s) present;
4. Circumstances of exposure;
5. Pharmacological factors such as tolerance, interactions or synergy.

### *3.11.2.1 What Toxicological Breakthroughs are Possible?*

Bloodstains may soon be able to give forensic analysts a crucial piece of information-- the age of the victim. A new method devised by University at Albany chemists Kyle Doty and Igor Lednev was recently published in the American Chemical Society Journal *Central Science*.<sup>8</sup> Using blood from 45 donors, they were able to distinguish unique profiles from the newborns, adolescents, and adults.

It is quite amazing what medical research is doing in blood testing. Scientists have now developed a blood test for Alzheimer's disease and found that it can detect early indicators of the disease long before the first symptoms appear in patients. The blood test offers an opportunity to identify those at risk and hopefully will open new avenues in treating Alzheimer's. Western Australian researchers have reported developing a blood test that can detect early stage melanoma skin cancers. Early detection and treatment are key to curing melanoma. Phlebotomy, the process of opening a vein and collecting blood for testing and diagnosis, is regularly used to measure cells, lipids, proteins, sugars, hormones, tumor markers, and other blood components. But the results from blood tests can often take days or weeks and therein lies a challenge for the next generation of toxicological breakthroughs: can accurate results be obtained in a shorter period of time?

### *3.11.2.2 What Kind of Testing?*

Because there are wide variations in the physical and chemical properties of xenobiotics in blood and urine, there is no universal chemical screen. Qualitative analysis detects the presence of a substance. Quantitative analysis determines the concentration of the substance. Screening tests include color tests, immunoassays, spectrophotometry, and thin layer chromatography. Confirmatory tests consist of the detection of a chemical substance by non-specific tests and must be confirmed by a second more specific technique based on a different chemical principle. As a rule of thumb, while screening tests may be cheaper and quicker, they are far less accurate than more sophisticated tests such as thin layer chromatography.

Hair analysis can be used for the determination of drug use months after drug consumption. More recently developed methods offer excellent sensitivity and can



make distinction between chronic heroin and codeine use, which was not possible earlier with radioimmunoassay techniques.

### 3.11.3 Fiber analysis

Fiber analysis cannot actually pinpoint a suspect in an investigation since it is not as reliable as DNA. A large share of forensic science techniques involving the analysis of physical evidence have never been validated scientifically. The National Academy of Sciences concluded that, with the exception of nuclear DNA analysis, no forensic method has been rigorously shown to consistently and with a high degree of certainty demonstrate a connection between evidence and a specific individual or source and have not developed evidence-based estimates of error rates.<sup>9</sup> The Academy report also noted that forensic analysts are subject to “contextual bias,” which occurs when the analysts are influenced by knowledge about the suspect’s background or other case information.<sup>10</sup>

*A large share of forensic science techniques involving the analysis of physical evidence have never been validated scientifically.*

Forensic fiber analysis is a body of knowledge that involves laboratory testing of fiber samples found at crime scenes to determine their origin. Properly done, experts can identify the material present and link it to the same material somewhere else. ASTM, formerly known as the American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services. As stated in ASTM E2225-10 – Standard Guide for Forensic Examination of Fabrics and Cordage, gaining an understanding of “the construction, composition, and color of a textile can aid the examiner in including or excluding a textile for consideration in a forensic examination.”<sup>14</sup>

The first step of the analysis of fibers of interest is their extraction. This part of the process sounds fairly simple, but the first part of the process needs to effectively prevent contamination of the sample. ASTM E2228-10 – Standard Guide for Microscopic Examination of Textile Fibers proposes several recommended

extraction methods, including tweezers, tape lifting, and gentle scraping. Tape lifts should be placed on clear uncontaminated substrate, and efforts need to be made to keep all materials clean. After extraction, fibers are examined with a stereomicroscope, with which physical features, such as crimp, length, color, relative diameter, luster, apparent cross section, damage, and adhering debris, are noted. Observations of these can help to classify the fiber samples into broader groups, such as synthetic, natural, or inorganic. Narrowing down the originating options for a fiber prevents the forensic specialists from pursuing any false conclusions. For example, one can classify a fiber as a strand of animal hair if it carries its common morphological features: the root, medulla, cortex, and cuticle. Experts can then determine the species of the animal through additional features on the hair shaft.<sup>15</sup>

There are no set standards, for the number and quality of character other textiles are produced using the same fiber types and color. The inability to positively associate a fiber to a particular textile to the exclusion of all others does not mean that a fiber association is without value.”<sup>16</sup> But to repeat, fiber examiners agree, however, that none of these characteristics is suitable for individualizing fibers (associating a fiber from a crime scene with one, and only one, source) and that fiber evidence can be used only to associate a given fiber with class of fibers.<sup>17, 18</sup>

#### 3.11.4 Medico-Legal Death Investigation

Half a million deaths are the subject of a medico-legal death investigations each year.<sup>19</sup> Medico-legal death investigation involves the scientific examination of unexplained deaths including those from homicides, suicides, blunt-force injuries, sharp-force, gunshot, and toxicological.<sup>20</sup> These investigations should be performed in accordance with each state’s laws.<sup>21</sup>

There are two types of medico-legal death investigation systems, the Medical Examiner system and the Coroner system. Twenty-two states utilize a statewide medical examiner systems, with eleven others using a coroner systems, while the remaining states use a hybrid system: where some counties served by coroners, others by medical examiners, and still others a combined system where the coroner refers cases to a medical examiner.<sup>22</sup>





The major differences between coroners and medical examiners arise in the manner of their selection by the electorate versus appointment by the executive branch. Medical examiners also have the medical and scientific expertise required for a physical examination of the deceased, while a coroner is not required to have any medical or scientific training.<sup>23</sup> Coroners can be elected or appointed. Some are also sheriffs or funeral home directors. Many coroners are not doctors. There are also medical examiners, who usually are medical doctors but may not be forensic pathologists trained in death investigation. The National Academy of Sciences has criticized the lack of mandatory standards for autopsies and the absence of oversight into the performance of coroners and medical examiners. The Academy recommended that the goal of every state should be to move to hire board certified forensic pathologists and put them to work as medical examiners.<sup>24</sup>

Autopsies are not for the faint of heart and the description of what occurs can be disturbing to jurors. In the U.S., the predominant technique used in an autopsy involves a Y-shaped incision. The incision begins at each shoulder and extends downward, meeting the midline of the body in the lower chest, then the incision extends to the top of the pubic bone. The chest plate is removed by cutting the ribs on both sides, exposing the heart and lungs. Samples of blood, bile, urine, and eye fluid are collected. Each organ is examined, removed, weighed, photographed, and dissected. Next the heart, lungs, pancreas, spleen, liver, kidneys, prostate, and gastrointestinal tract (small and large intestines) are removed. The brain is removed by first making an incision ear to ear, reflecting the scalp and exposing the skull, then using a reciprocating bone saw to create a circular cut of the skull allowing the removal of the skullcap and the brain. Microscopic slides are made of each organ. Typically, the collected body fluids are sent to a forensic toxicologist for analysis. That analysis generates a toxicology report that lists all the compounds by type and concentration detected in the different body fluids.

Because the expertise of those who perform medico-legal death investigations varies widely, the trial judge's challenge is to determine whether their testimony is sufficient to offer expert testimony. A good example of this can be found in the case of *Verzwyvelt v. St. Paul Fire & Marine Ins. Co.*<sup>25</sup> Plaintiff brought suit alleging death from eating sausage meat contaminated with listeria. The coroner, had not tested specifically for the listeria bacteria, and admitted he had "little or no scientific knowledge concerning listeria, listeria infections, or the subfield



of hematopathology.”<sup>26</sup> The court allowed him to testify, as he was a forensic pathologist, but prevented him from testifying as to any opinion regarding the cause or nature of the bacterial infection that was presumably the cause of death as he was not qualified to do.<sup>27</sup>

### 3.11.5 Fire Debris / Arson, Explosion Analysis

The bombing of the Pan Am Flight 103 over Lockerbie, Scotland in 1988 created the largest crime scene in the world. It stretched for more than 1,200 square miles. By painstakingly piecing together the wreckage that was found in this area, investigators identified trace amounts of explosives that helped confirm the incident was indeed caused by a terrorist attack.

The Lockerbie explosion analysis was unique, but it illustrates what a well-funded investigation is capable of. Fire, explosion, and arson investigations examine the physical attributes of a fire or explosion.

Evidence of accelerants and burn patterns may indicate criminal activity. These types of analyses can be mishandled,<sup>28</sup> but they can be accurate and there is support for improvement in the field. For example, the National Institute of Justice funds research to develop new and improved tools and techniques to interpret, identify, and analyze fire and explosion evidence.<sup>29</sup>

Fire debris and explosives analysis has become more reliable because of new technology. Advances in analytical chemistry, digital imaging, robotics, and data recording are presenting new tools and technology. For example, the development and validation of instrumentation that is capable of indicating the probability match of ignitable liquids recovered from a fire scene, to ignitable liquids on the person, or in the possession of a suspect or victim. New technology could essentially provide a DNA analysis for fire debris. Instrumentation used in other analytical areas that may have an application are: two-dimensional gas chromatography which mass spectral detection (GC x GC/MS);

*Since 1989, more than 50 people have been officially exonerated on the basis that there was no arson. However, fire debris and explosives analysis has become more reliable because of new technology.*



Stable Isotope Ratio Mass Spectroscopy; Gas Chromatography with tandem mass spectral detection (GC/MSn) or Fourier Transform Ion Cyclotron Resonance Mass Spectroscopy. Another area of interest is development and validation of “expert system” software for GC/MS that can rapidly compare data from case samples with a reference library of ignitable liquid standards to form probability match lists.<sup>30</sup>

### 3.11.6 Practice Pointers For Trial Judges

“Slow and painful has been man’s progress from magic to law.” That proverb, which is mounted at the University of Pennsylvania Law School on a statute of Hsieh-Chai, a mythological Chinese beast with the power to discern guilt, serves as an important metaphor for trial judges dealing with forensic analysis.

Can a judge safely rely on established case law regarding forensic analysis? The short answer is: maybe. The law is somewhat fixed. A trial judge can find him- or herself in a difficult spot when there is an Appellate Court decision saying one thing, and new forensic technology saying another. When this happens, judges need to be prepared for the possibility that it may be time to depart from the current state of the law.

### 3.11.7 A Sampling of Cases on Scientific Evidence

#### FORENSIC ANALYSIS OF FIBERS

Boyd v. State 200 So.3d 685 (2015). Trial counsel was not ineffective in failing to request a Frye hearing on forensic methodologies and evidence presented. Trace and microscopic fiber analysis, forensic odontology and bite-mark analysis, and short tandem repeat (STR) DNA technology were not new nor novel at the time of trial.

People v. Prieto, 124 P.3d 842 (2005). “The court found that the fiber examination may be considered subjective because the expert examined the fibers through the filter of her own eye. However, the expert was trained in fiber analysis at the FBI, fiber analysis is

subject to CBI standard operating procedures, the standard operating procedures used are accepted within the forensic community, and her test was subject to peer review. The court noted that although this expert was not going to render a conclusive opinion, her findings of consistency among the fibers might be helpful to the jury and certainly would be relevant. We conclude that the court did not err in admitting the fiber expert's testimony.”

*Fox v. State*, 266 Ga.App. 307, 596 S.E.2d 773 (2004). Trial court did not abuse its discretion in qualifying state's witness as expert in fiber analysis. “[T]he State's expert fiber analyst had worked at the Georgia Bureau of Investigation for two years as a microanalyst in the Forensic Sciences Division, and had a bachelor of science degree in Forensic Science. She also completed a nine-month training course in the hair and fiber fields, and ‘completed several oral and written tests.’ Her duties included analyzing, comparing, and evaluating physical evidence including hairs, fibers, and shoeprints. She had worked on approximately 50 cases while she was employed at the GBI. Previously, she had testified as an expert in hair analysis and physical evidence, but not as a fiber expert.”



## 3.11.8 Endnotes

1. P.L. KIRK, CRIME INVESTIGATION at 4. (Interscience Publishers, N.Y., 1953)
2. For example, the Supreme Court of Massachusetts ordered the dismissal of more than 11,000 drug convictions, as they may be tainted by the misconduct of former Massachusetts forensics chemist Sonja Farak. Farak worked in a Massachusetts drug analysis lab from 2003 until her arrest in January 2013. She served an 18-month prison sentence after being convicted of tampering with evidence, stealing illegal drugs from the facility where she worked, and cocaine possession. For six months, Farak actually overlapped at the Hinton drug lab with another disgraced Massachusetts state forensic chemist, Annie Dookhan, who was sentenced to three to five years in prison in November 2013 after admitting to mixing evidence samples and falsifying results. The Massachusetts Supreme Court directed that nearly 22,000 criminal drug cases affected by Dookhan's misconduct be overturned. That was the largest dismissal of wrongful convictions in US history.
3. BRENT TURVEY, FORENSIC FRAUD: EVALUATING LAW ENFORCEMENT AND FORENSIC SCIENCE CULTURES IN THE CONTEXT OF EXAMINER MISCONDUCT 2 (2013).
4. WILLIAM SCHWABE, ET AL., CHALLENGES AND CHOICES FOR CRIME-FIGHTING TECHNOLOGY: FEDERAL SUPPORT OF STATE AND LOCAL LAW ENFORCEMENT (2001).
5. FORENSIC TOXICOLOGY – A PRIMER FOR LAWYERS, LAWGAZETTE.COM, <http://v1.lawgazette.com.sg/2016-05/1565.htm>.
6. *Id.*
7. *See* State v. Robinson, 517 N.W.2d 336 (Minn. 1994) (Unless suspected drug is so homogeneously packaged as to permit extrapolating the total weight of the drug from random sample testing, the state must present evidence that all of the substance necessary to meet the minimum statutory weight was tested and identified as the suspected drug.), Alan Julian Izenman, *Statistical and Legal Aspects of the Forensic Study of Illicit Drugs*, 16 STATISTICAL SCIENCES 1 35, 36 (2001).
8. Kyle C. Doty & Igor K. Lednev, *Differentiating Donor Age Groups Based on Raman Spectroscopy of Bloodstains for Forensic Purposes*, 4 AM. CHEMICAL SOC. CENT. SCI. 7, 862-867 (2018).
9. NAT'L RES. COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (National Academies Press, 2009).



10. *Id.*
11. JOHN GLAISTER, HAIRS OF MAMMALIA FROM THE MEDICO-LEGAL ASPECT (1931).
12. JOHN GLAISTER, A STUDY OF HAIRS AND WOOLS BELONGING TO THE MAMMALIAN GROUP OF ANIMALS, INCLUDING A SPECIAL STUDY OF HUMAN HAIR (MISR Press, Univ. of Egypt, 1931).
13. MICROSCOPY OF HAIRS: A PRACTICAL GUIDE AND MANUAL (Univ. of Mich. Libr., 1977).
14. ASTM STANDARD E2225-10, STANDARD GUIDE FOR FORENSIC EXAMINATION OF FABRICS AND CORDAGE, (ASTM International, 2010), [www.astm.org](http://www.astm.org)
15. Brad Kelechava, *Forensic Fiber Analysis Standards*, American National Standards Institute, (July 18, 2018) <https://blog.ansi.org/?p=7140>.
16. FORENSIC EXAMINATION OF FIBRES 91 (James Robertson & Michael Grieve eds., 2d ed. 1999).
17. See e.g., R.R. Bresee, *Evaluation of textile fiber evidence: A review*, 32 J. OF FORENSIC SCIENCES 2, 510-521 (March 1987), Available at [https://www.researchgate.net/publication/281246146\\_Evaluation\\_of\\_Textile\\_Fiber\\_Evidence\\_A\\_Review](https://www.researchgate.net/publication/281246146_Evaluation_of_Textile_Fiber_Evidence_A_Review), which includes the following summarization in Section 5.4: “It can never be stated with certainty that a fiber originated from a particular textile because other textiles are produced using the same fiber types and color. The inability to positively associate a fiber to a particular textile to the exclusion of all others, however, does not mean that a fiber association is without value.”  
  
*See also* SWGMAT, *Introduction to forensic fiber examination*, 1 FORENSIC SCIENCE COMMUNICATIONS 1 (April, 1999).
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22. *Id.*; For example: Idaho, some parts of California, Colorado, Kansas, Nebraska, Nevada, some parts of New York, South Carolina, South Dakota, some areas in Texas, some parts of Washington, and Wyoming use the coroner system.  
  
Alaska, Alabama, Arkansas, Connecticut, Delaware, Georgia, Iowa, Kentucky, Maine, Maryland, Massachusetts, Mississippi, Montana, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, Rhode Island, Tennessee, Utah, Vermont, Virginia, and West Virginia use the medical examiner system. Arizona and Michigan have medical examiners in each county, but they are not necessarily pathologists.  
  
Washington, Texas, Hawaii, Minnesota, Wisconsin, Ohio, Illinois, Pennsylvania, and New York use both the coroner and medical examiner systems. Arkansas, Kentucky, Mississippi, Montana, and North Dakota have coroners in their counties, but they also have a state medical examiner.
23. *Id.*
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# 3. SCIENTIFIC EVIDENCE

Section 3.12  
DNA Evidence

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**HON. MING CHIN (RET.)**

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### 3.12.1 Introduction

As the U.S. Supreme Court has recognized, “DNA testing has an unparalleled ability both to exonerate the wrongly convicted and to identify the guilty. It has the potential to significantly improve both the criminal justice system and police investigative practices.”<sup>1</sup> But DNA testing also raises some unique concerns. This section provides a brief overview of the legal issues resulting from the collection, testing, storage, discovery and admissibility of DNA evidence.

#### 3.12.1.1 *What is DNA?*

Deoxyribonucleic acid (DNA) is a large molecule coiled up tightly inside the nucleus of most cells in the human body.<sup>2</sup> It comprises two complementary strands of nucleotides held together by approximately three billion base pairs. The sequence of these base pairs, considered collectively in the form of a profile, are extremely useful as a forensic identifier because of the high degree of variability among individuals.<sup>3</sup> About one-tenth of one percent of human DNA (about three million bases) differs from person to person, which means that the order of the bases varies on average by one base in 1,000.<sup>4</sup>

DNA is a type of physical evidence that helps link an offender to a crime scene.<sup>5</sup> The first step in forensic use of DNA is typically collecting a sample of biological material from a crime victim or a crime scene.<sup>6</sup> The ability to use DNA as an identifier has expanded the types of biological evidence that is useful in litigation because all biological evidence found at a crime scene can be tested for DNA.<sup>7</sup> Scientists identify a limited number of genetic markers in the collected sample by deploying small pieces of manufactured chemical sequences (primers) that seek out and bind to complementary DNA sequences of interest in the sample.<sup>8</sup> A series of primers bound to a DNA sample permits amplification of the original sample to the point that the analyst can determine a DNA “profile” for the person who was the source of the sample.<sup>9</sup>

The next step is to compare a DNA profile of an unknown source to a profile of a suspect or to the millions of DNA profiles stored in computer databases of law enforcement agencies throughout the country.<sup>10</sup> To reduce the chance of misidentification, profiles are typically based on 20 or more DNA regions, or



loci, that vary from person to person.<sup>11</sup> A match between the profiles means that a single person could be the source of both DNA samples, a determination that is informed by the statistical rarity of the DNA profile at issue.<sup>12</sup> A finding of no match eliminates the known suspect as the source of the DNA collected from the victim or at the crime scene.<sup>13</sup>

### *3.12.1.2 Uses of DNA Evidence in Court*

DNA evidence has been playing an important role in our legal system for some time. In criminal cases, DNA has dramatically affected questions of identity. Police, prosecutors, and defense counsel rely heavily on DNA evidence to do their jobs. Throughout the country, huge DNA databanks are being compiled with genetic information of convicted offenders, arrestees, suspects, victims and their family members, and even witnesses, for later comparison with DNA samples collected at crime scenes or from victims. These databases have enabled law enforcement authorities to make arrests in crimes that have gone unsolved for decades. Of course, DNA identity evidence may also aid the accused; all fifty states currently give inmates access to DNA evidence and testing that might not have been available at the time of trial. As of November 2018, there had been 362 post-conviction DNA exonerations in the United States.<sup>14</sup>

*The impact of  
DNA evidence in  
criminal trials  
extends beyond  
matters of identity.*

The impact of DNA evidence in criminal trials extends beyond matters of identity. In a 1998 death penalty case in Georgia, a defendant complained that his counsel conducted an inadequate mitigation defense by failing to pursue genetic testing that might have shown a genetic basis for his violent and antisocial behavior.<sup>15</sup> The highest state court in Georgia affirmed the death sentence, but not because it questioned this use of genetics as mitigation evidence.<sup>16</sup> In California, juries convicted two alcoholic lawyers in separate matters for embezzling money from clients. The attorney who claimed that a genetic disorder caused his alcoholism received a lighter sentence.<sup>17</sup> In another case, a jury found an accused murderer not guilty when her violence was linked to her Huntington's disease.<sup>18</sup>



Civil litigants also use genetic evidence in various new ways. Defendants in personal injury cases offer it on issues of both causation and damages. For example, in one toxic tort case, a chemical company whose toxins allegedly injured a child successfully sought a court order for genetic testing, hoping to establish that the child's condition was due to a genetic condition unrelated to the alleged exposure.<sup>19</sup> In other toxic tort cases, a defendant may offer DNA evidence of a plaintiff's genetic predisposition to a particular disease, and argue either that there was no causation — because that predisposition, not the defendant's product, caused the disease — or that damages should be reduced because the plaintiff would have

*DNA may be introduced in civil and family law cases, not just criminal proceedings.*

developed the disease regardless of the exposure.<sup>20</sup> A defendant may also offer genetic evidence that the plaintiff was not exposed to the defendant's product, or does not have a susceptibility to disease as a result of the exposure, or has a particular sensitivity and was actually exposed to some other product that causes the same disease.<sup>21</sup> To reduce damages awarded for an exposure that causes a life-long disability, a defendant may even offer DNA evidence to show that the plaintiff, for genetic

reasons, will have a shortened life.<sup>22</sup> Conversely, plaintiffs in toxic tort cases may offer DNA evidence on various issues, such as the fact and extent of exposure and predisposition to develop disease from a particular product.<sup>23</sup> This kind of evidence may be especially useful in "latent risk" cases, where plaintiffs assert they are at increased risk of developing disease in the future due to an exposure.<sup>24</sup> In short, genetic evidence has the potential to "transform toxic injury litigation."<sup>25</sup>

DNA evidence has also impacted family court judges. In family law cases, genetic evidence has traditionally been used to resolve disputes about paternity.<sup>26</sup> Today, it also may affect questions about parental rights. In South Carolina, for example, a judge deciding whether to terminate parental rights ordered a mother to be genetically tested for Huntington's disease.<sup>27</sup>

### *3.12.1.3 Procedures and Concerns in Handling DNA Evidence*

However a litigant intends to use DNA evidence, safeguarding and preserving it is fundamental to success. Issues of admissibility may arise from the procedures



followed in gathering and testing DNA evidence from a crime scene, such as the risk of contamination from incidental activity. It is important for law enforcement personnel to avoid any action that could compromise the crime scene, including smoking, eating, drinking, and littering.<sup>28</sup> DNA evidence is more sensitive than other types of evidence, so law enforcement personnel should be especially aware of their actions in order to prevent inadvertent contamination.<sup>29</sup>

Documentation about chain of custody is another critical issue for those collecting DNA evidence. For example, where laboratory analysis reveals contamination of the evidence, chain of custody records will be required for identification of those who have handled the evidence.<sup>30</sup> In terms of processing DNA evidence, reducing the number of people who handle the evidence will lower the risk of contamination, simplify the proof required for admission, and eliminate avenues of cross-examination that could undermine the evidence's persuasive force. To check for processing errors, many laboratories compile "a staff elimination database" containing the DNA profiles of laboratory personnel, and run test results through it to identify contaminating DNA profiles.<sup>31</sup> It is also good practice to note in the documentation whether the DNA evidence was found wet or dry or includes blood spatters.

*Procedures for collection of DNA and chain of custody issues may affect admissibility or weight of the evidence.*

Direct sunlight and warmer conditions may degrade DNA, so the best way to preserve DNA evidence is to keep it in a cold environment. Therefore, officers transporting DNA evidence, in addition to maintaining chain of custody, should avoid storing the evidence in places that may get hot, such as the trunk of a car. Any probative biological sample that has been stored dry or frozen, regardless of age, may be considered for DNA analysis. Nuclear DNA from blood and semen stains that are more than 20 years old has been analyzed successfully using polymerase chain reaction (PCR).<sup>32</sup> Samples that have been stored wet for an extended period may be unsuitable for DNA analysis.<sup>33</sup>

Some biological samples are not considered suitable for DNA testing with current techniques, including embalmed bodies (with the possible exception of bone or plucked hairs), pathology or fetal tissue samples that have been immersed

in formaldehyde or formalin for more than a few hours (with the exception of pathology paraffin blocks and slides), and urine stains.<sup>34</sup> Other biological samples such as feces, fecal stains, and vomit can potentially be tested, but most laboratories do not routinely accept them for testing.

#### *3.12.1.4 Data Analysis and Interpretation*

After DNA evidence has been collected and properly tested, the next step is analyzing and interpreting the test results. If there is a “match” between the profile of the known individual and that of the unknown crime scene sample or the victim — meaning that the sequences in the sample from the known individual are all consistent with or present in the sequences in the unknown crime scene sample or the victim’s sample — the result is considered an inclusion or non-exclusion.<sup>35</sup> This means that the known individual is included (cannot be excluded) as a possible source of the DNA found in the sample found at the crime or taken from the victim. Often, statistical frequencies regarding the rarity of the particular profile of genetic information observed in the unknown evidence sample and for a known individual are provided for various ethnic groups.<sup>36</sup> If the initial testing that produces the match involves comparison of only one or a few loci, then the possibility of including an innocent person as the source of the DNA increases, and comparison of additional loci should be done with remaining evidence. Also, there are circumstances in which a match is not legally meaningful, e.g., when the sequences are all consistent with those of the individual from whom the samples were collected (e.g., victim’s sequences only on vaginal swabs taken from the victim; defendant’s sequences only on a bloodstain on defendant’s clothing).<sup>37</sup>

*A DNA match has little significance without statistical information about the likelihood it occurred randomly.*

A match has little significance without statistical information about the likelihood it occurred randomly. The lower the likelihood the match was random, the higher the likelihood the source of the matching profile was also the source of the DNA obtained at the crime scene or from the victim. To determine the rarity of a sample’s genetic profile, experts use the “product rule,” which involves selecting a set of genetic markers from the sample, estimating the frequency with which each marker

appears in the relevant population, and multiplying the frequencies together to produce the complete profile's frequency in the population. The resulting number may be described as the probability that the DNA of someone selected at random from the relevant population will match the DNA of the evidentiary sample.<sup>38</sup>

A match that results from running the DNA profile of a sample from an unknown source through a database of DNA profiles is called a “cold hit.” Because these databases contain thousands, or sometimes millions, of profiles, and even unrelated people share, on average, two or three genetic markers, disputes may arise as to the significance of a cold hit. Defendants in cold hit cases sometimes challenge the use of the product rule, arguing that it fails to factor in the increased likelihood of a match that results when so many comparisons are done and thus does not accurately represent the probability of a random match. Appellate courts addressing this issue have held that, although the result of the product rule produces does not accurately express the probability of a random match in cold hit cases, it nevertheless is relevant and admissible because it accurately expresses the frequency with which a particular DNA profile appears in the general population.<sup>39</sup> These courts have also recognized, however, that a probability statistic reflecting the increased likelihood that a database search would produce a match may also be relevant and admissible.<sup>40</sup>

If testing fails to show a “match” between the profile of the known individual and that of the unknown crime scene sample or the victim — meaning that the sequences of the sample from a known individual are not all present in the sample obtained at the crime scene or from the victim — then the result is considered an exclusion, a nonmatch, or non-inclusion.<sup>41</sup> With limited exceptions, a nonmatch at any one loci of genetic comparison eliminates the provider of the sample as a potential source of the DNA found in the other tested sample.<sup>42</sup> However, in some contexts, additional testing may be necessary to make a nonmatch result meaningful, e.g., in a sexual assault case, when the suspect is excluded as the source but no samples are available from the victim and/or consensual partners.

A third possibility is that the testing is inconclusive. This can occur when the amount of DNA suitable for testing is too limited to yield more than partial results, or there are no samples from known individuals to compare with samples obtained at the crime scene or from the victim.<sup>43</sup>



### 3.12.2 DNA Databases

#### 3.12.2.1 CODIS and NDIS

In 1990, the Federal Bureau of Investigation (FBI) started the Combined DNA Index System (“CODIS”), a pilot project to coordinate the DNA databases of 14 state and local laboratories.<sup>44</sup> Today, CODIS houses the National DNA Index System (“NDIS”), which allows more than 190 federal, state, and local law enforcement labs to exchange and compare DNA profiles electronically, greatly facilitating

*More than 190 federal, state, and local law enforcement labs exchange and compare DNA profiles electronically.*

criminal investigations and searches for missing persons.<sup>45</sup> As of October 2018, NDIS contained over 13,566,716 offender profiles, 3,323,611 arrestee profiles, and 894,747 forensic profiles, and had produced more than 440,346 hits, assisting in more than 428,808 investigations.<sup>46</sup>

In criminal investigations, CODIS allows an analyst at a participating lab to upload an unidentified DNA profile created from crime scene evidence and to search it against two indexes: the

Convicted Offender or Arrestee Index, which contains the DNA profiles of convicted or arrested individuals, and the Forensic Index, which contains unidentified DNA profiles from other criminal investigations.<sup>47</sup> If a match is identified, additional steps are taken to confirm the match. If there is a confirmed match with a DNA profile stored in the Convicted Offender or Arrestee Index, then the analyst working with the unidentified DNA profile may obtain the identity of the suspect from an analyst in possession of the known DNA profile. If there is a confirmed match with a DNA profile stored in the Forensic Index, then analysts and law enforcement personnel may share information about their investigations and possibly develop new leads.

#### 3.12.2.2 Federal Privacy, Quality Assurance, and Expungement Requirements

##### (i) CODIS Privacy Measures





CODIS does not store names or other personal information, so no personal information is shared before confirmation of a match.<sup>48</sup> At the national level, only the following is stored and may be searched for:

- the DNA profile (the set of identification characteristics or numerical representation at each of the various loci analyzed);
- the Agency Identifier of the agency that uploaded the DNA profile;
- the Specimen Identification Number (a number assigned at the time of sample collection); and,
- the DNA lab personnel associated with the DNA profile analysis.<sup>49</sup>

Access to DNA samples and records is generally limited to participating federal, state, and local agencies and labs, and to defendants insofar as they may access samples and analyses performed in connection with their cases.<sup>50</sup>

#### **(ii) NDIS Laboratory Participation Requirements**

NDIS establishes quality assurance, privacy, and expungement requirements for participating labs, including the following:<sup>51</sup>

- compliance with FBI Quality Assurance Standards (QAS);<sup>52</sup>
- external audits every two years to demonstrate compliance with the QAS;
- accreditation by a nonprofit professional association of persons actively engaged in forensic science that is nationally recognized within the forensic science community;
- limiting access to DNA samples and records in accordance with federal law.<sup>53</sup>

Participating states must agree, by signing a Memorandum of Understanding, to abide by the DNA Identification Act's requirements as well as other record-keeping requirements and operational procedures.<sup>54</sup>

### (iii) NDIS DNA Data Requirements

As of December 2018, NDIS only accepted DNA data generated through the Polymerase Chain Reaction (PCR) Short Tandem Repeat (STR), Y chromosome (Y-STR), and Mitochondrial DNA (mtDNA) technologies.<sup>55</sup> Additional requirements include:

- DNA data has been produced by a lab that meets the laboratory participation requirements (above) and follows expungement procedures in accordance with federal law;
- DNA data fall within an acceptable NDIS category, such as convicted offender, arrestee, detainee, legal, forensic (casework), unidentified human remains, missing person, or a relative of missing person;
- DNA data meet minimum CODIS Core Loci requirements for the specimen category;
- DNA PCR data generated using PCR accepted kits.<sup>56</sup>

*A profile of a person whose conviction has been reversed must be expunged from data bases.*

### (iv) NDIS Expungement Requirements

Labs must expunge profiles of convicted individuals upon receiving a certified copy of a final court order documenting reversal of the conviction. Labs must expunge profiles of arrestees upon receiving a certified copy of a final court order documenting that no charges were brought within the applicable time period or that any charges were dismissed or resulted in acquittal.<sup>57</sup>

### (v) FBI Quality Assurance Standards (QAS)

The FBI's QAS describe the minimum standards for labs performing DNA analysis and/or databasing, and cover the following areas: organization, personnel, facilities,

evidence or sample control, validation, analytical procedures, equipment calibration and maintenance, reports, review, proficiency testing, corrective action, audits, safety, and outsourcing.<sup>58</sup>

### 3.12.2.3 *Local Databases*

Police investigators increasingly rely on their own local DNA databases instead of the FBI's national DNA database network, because of federal restrictions regarding CODIS and NDIS.<sup>59</sup> These local databases largely operate outside of federal regulation, so they are not limited to convicted offenders and arrestees; they often also contain DNA profiles of suspects, victims and their family members, witnesses, and abandoned biological material.<sup>60</sup> Use of these local databases is controversial. Supporters argue that the practice “allows police to maximize the potential of genetic surveillance to solve crimes,”<sup>61</sup> but critics assert that it “has unleashed significant negative forces that threaten privacy and dignity interests, exacerbate racial inequities in the criminal justice system, and undermine the legitimacy of law enforcement.”<sup>62</sup>

## 3.12.3 Fourth Amendment Issues

The Fourth Amendment to the United States Constitution protects the right to be free from “unreasonable” government “searches and seizures.”<sup>63</sup> According to U.S. Supreme Court decisions, a search occurs when the government intrudes upon a reasonable expectation of privacy;<sup>64</sup> a seizure of property occurs when the government meaningfully interferes with a possessory interest;<sup>65</sup> and, a seizure of a person occurs when freedom of movement is restrained by means of physical force or show of authority, and a reasonable person would believe he or she was not free to leave.<sup>66</sup> A warrant supported by probable cause is generally required for a search or seizure, but there are exceptions to this requirement “because the ultimate touchstone of the Fourth Amendment is ‘reasonableness’.”<sup>67</sup> This section provides an introduction to some of the Fourth Amendment issues that arise in connection with collecting biological samples for DNA testing and creating, storing, and comparing DNA profiles.

### *3.12.3.1 Collecting Biological Samples for DNA Testing*

#### **(i) Collecting Biological Samples from a Person’s Body without Consent**

The U.S. Supreme Court has recognized that an “intrusion into the human body” by the government—such as swabbing the inside of a cheek, scraping fingernails, or withdrawing blood—constitutes a Fourth Amendment search.<sup>68</sup> Thus, without a warrant supported by probable cause, law enforcement officers generally may not collect a biological sample without consent.

*Taking a DNA sample is a search for Fourth Amendment purposes.*

The analysis changes, however, upon a person’s arrest for or conviction of a serious crime. For example, the U.S. Supreme Court has held that when law enforcement officers, after making an arrest supported by probable cause for a serious offense, bring the arrestee to the station for custodial detention, they may swab the inside of the arrestee’s cheek to collect an evidentiary sample for DNA testing.<sup>69</sup> The reasonableness of this “legitimate police booking procedure” is established by the government’s significant interests in identifying persons taken into custody and solving crimes, the unique effectiveness of DNA identification, the minimal intrusion of a cheek swab, and the reduced privacy expectation of those in police custody.<sup>70</sup> Likewise, the government may, without a warrant and without consent, collect evidentiary samples for DNA testing from those convicted of felony crimes.<sup>71</sup>

#### **(ii) Collecting Biological Samples from a Person’s Body with Consent**

Consent allows law enforcement officers to conduct a search and/or make a seizure without a warrant and without probable cause, provided that the consent is voluntarily given<sup>72</sup> and the search and/or seizure does not exceed the scope of consent.<sup>73</sup> Consent is “voluntarily given” when, under the totality of the circumstances, it is “not the result of duress or coercion, express or implied.”<sup>74</sup> The scope of consent is determined by asking what a reasonable person—knowing what the officer knew at the time—would have understood the individual to have



consented to.<sup>75</sup> Both the voluntariness and the scope of consent are questions of fact entitled to deference upon appeal.

When a person provides a biological sample in cooperation with a law enforcement investigation, unique concerns may arise about the scope of consent. First, the person may not have known, at the time of consent, that the government would use the sample for DNA testing. This issue may arise because today's technology allows DNA analysis on samples that were taken before DNA testing was even available. When faced with this issue, an appellate court in Connecticut concluded that, because the defendant had consented to "a complete search" of his saliva samples without limiting when or how they could be tested, DNA tests performed over 20 years later did not exceed the scope of his consent. "[A] reasonably objective person," the court reasoned, "would understand that the police obtained the saliva sample with the intention of determining who committed the victim's murder and that they would continue their search until they found the person responsible."<sup>76</sup>

Second, the person providing the sample may not know that the government intends to use the resulting DNA profile in other law enforcement investigations. In a Maryland case presenting this issue, the appellate court concluded that, because the defendant signed a consent form acknowledging that "any evidence found to be involved in this investigation ... can be used in any future criminal prosecution," running his DNA profile through state and county DNA databases, after testing showed he was the source of DNA collected in the case under investigation, did not exceed the scope of his consent.<sup>77</sup>

Cases like these suggest that when someone provides a biological sample for use in an investigation without expressly limiting the scope of consent, officers may use the sample for DNA testing and may use the resulting DNA profile in connection with other investigations.<sup>78</sup>

### **(iii) Collecting Biological Samples from Items Lawfully in Government Custody**

Collecting biological samples for DNA testing from items lawfully in the government's possession generally does not constitute a search.<sup>79</sup> One court has

held, however, that when law enforcement officers have an item from the victim of one crime, and they suspect that the victim committed an unrelated crime, they need a warrant to collect a DNA sample from the item.<sup>80</sup>

#### **(iv) Collecting “Abandoned” Biological Samples**

The U.S. Supreme Court has held that there is no reasonable expectation of privacy in items abandoned in public.<sup>81</sup> This rule has been applied in cases where individuals have “abandoned” their biological material—or an item containing their biological material—in public.<sup>82</sup> Therefore, law enforcement officers do not need probable cause or a warrant to collect DNA from abandoned genetic material such as a straw, cup or cigarette.

##### ***3.12.3.2 Creating a DNA Profile from Lawfully Obtained Biological Samples***

The U.S. Supreme Court has stated that the collection of biological material and subsequent forensic analysis of that material constitute separate Fourth Amendment searches.<sup>83</sup> But it has also held that, given the limited genetic information sought and revealed by the loci involved in identity testing, analysis of DNA that has been lawfully collected does “not amount to a significant invasion of privacy that would render the DNA identification impermissible under the Fourth Amendment.”<sup>84</sup> At least one court has held, however, that the government needs a warrant to create a DNA profile from a victim’s DNA sample where the government suspects that the victim committed an unrelated crime.<sup>85</sup>

##### ***3.12.3.3 Storing and Comparing DNA Profiles***

Courts generally hold that retaining a DNA profile and comparing it to the profiles of later collected DNA samples does not constitute a Fourth Amendment search.<sup>86</sup> But Fourth Amendment concerns may arise when the government continues to store and use the DNA profiles of convicted persons after they have completed their sentences and any terms of parole or probation,<sup>87</sup> or of arrestees if no charges are brought within the required time period or after the charges have been dismissed or resulted in acquittal.<sup>88</sup>

### 3.12.3.4 *Familial testing*

A relatively new, but controversial, technique is familial database searching, which uses DNA to identify criminals through their relatives.<sup>89</sup> Investigators search databases for DNA profiles that closely resemble, but do not exactly match, the profile of DNA that an unidentified suspect left behind at the crime scene.<sup>90</sup> This technique is based on the scientific fact that a person's DNA is much more similar to the DNA of the person's biological relatives than to the DNA of unrelated persons.<sup>91</sup> Because of this fact, a partial match may, depending on its degree, suggest that the source of the DNA at the crime scene is a biological relative of the person identified from the database search.<sup>92</sup> Police can interview that person's relatives, hoping to identify and find the suspect.<sup>93</sup> Some claim that use of this technique could increase the yield of investigative leads by 40%.<sup>94</sup> The United Kingdom has been doing familial database searching since 2002, and has used it to solve several sensational crimes.<sup>95</sup> Maryland and the District of Columbia prohibit the technique, but as of 2018, ten states use it.<sup>96</sup>

*The use of  
familial data bases  
are prohibited in  
Maryland and  
the District of  
Columbia.*

Critics of this technique argue that it puts all family members under “genetic surveillance” for crimes they are not even alleged to have committed.<sup>97</sup> Others argue that “it turns family members into genetic informants without their knowledge or consent.”<sup>98</sup> Some legal scholars assert that a familial database search constitutes an unreasonable, and therefore unconstitutional, search.<sup>99</sup> In a 2010 decision, a federal appellate court noted that the government's use of CODIS to discover partial matches “[a]rguably” raises unique “privacy concerns.”<sup>100</sup> One constitutional law professor has warned that “if familial searching proceeds, it will create a political firestorm.”<sup>101</sup> Because of such concerns, the FBI has so far declined to pursue familial database searching.<sup>102</sup>

In a related technique, investigators are using commercial, publicly available genealogical/ancestry websites (such as Ancestry and 23 and Me) to search for genetic relatives of the unidentified person who is the source of DNA found at a crime scene. Through this technique, detectives in California recently arrested a 72-year-old man whom they believe committed a string of rapes and murders in

the 1970s and 1980s.<sup>103</sup> They submitted DNA leftover from some of those decades-old crimes to a commercial ancestry website and identified the suspect's great-

*In a criminal case, the statute of limitations does not begin to run until the DNA match occurs.*

great-great grandparents. They then constructed about 25 distinct family trees of their descendants, located two descendants who were about the suspect's age and had ties to the locations of the crimes, surveilled one of those descendants, recovered an item he discarded, and performed DNA testing on the discarded item. The testing produced a match between DNA on the discarded item and DNA recovered at one of the crime scenes.<sup>104</sup>

### 3.12.4 Procedural Issues

#### 3.12.4.1 Statutes of Limitations

In the criminal context, statutes of limitations limit the time period within which the government may file charges for criminal conduct. They primarily reflect a legislative judgment that at some point, the benefits of prosecuting an old crime are outweighed by the costs, primarily due to concern about the defendant's inability to obtain sufficient and accurate evidence for a defense.<sup>105</sup> Under the general statute of limitations for federal crimes, the government must file charges within five years of the offense.<sup>106</sup> There are several exceptions to this statute, however, including for capital offenses, terrorism, white collar crimes, and crimes against children.<sup>107</sup>

Many legislatures, in recognition of the accuracy and reliability of DNA testing, have created special exceptions to statutes of limitations for cases that may be solved with such testing.<sup>108</sup> Under federal law, if DNA testing implicates a known person in the commission of a felony, then "no statute of limitations . . . shall preclude such prosecution until a period of time following the implication of the person by DNA testing has elapsed that is equal to the otherwise applicable limitation period."<sup>109</sup> In other words, the statute of limitations does not begin to run until the DNA match occurs.<sup>110</sup>





#### 3.12.4.2 *Doe Warrants and Indictments*

Under federal law, if the DNA profile of an unidentified source implicates the source in a crime of sexual abuse, then the government may file an indictment against an “individual whose name is unknown, but who has a particular DNA profile” to effectively toll the statute of limitations.<sup>111</sup> At least one court has held that DNA-based “John Doe” indictments do not violate a defendant’s constitutional right to notice.<sup>112</sup>

Likewise, several states authorize the filing of an arrest warrant based on an unidentified suspect’s DNA profile, which allows prosecution to commence before the statute of limitations expires. The hope is that the suspect will later be identified through a DNA match. Provided that the DNA profile is sufficiently discriminating, state courts have upheld these DNA-based “John Doe” arrest warrants against federal and state constitutional challenges, including arguments that they violate the Fourth Amendment’s particularity requirement and the Sixth Amendment’s notice requirement.<sup>113</sup>

#### 3.12.4.3 *Pre-Indictment Delay*

Even if a prosecution does not violate the applicable statute of limitations, the U.S. Supreme Court has stated that the Due Process Clause may require dismissal of charges upon a showing that an unreasonable prosecutorial delay actually prejudiced the defendant’s right to a fair trial.<sup>114</sup> The high court has clarified, however, that unlike pre-indictment delay “to gain tactical advantage over the accused,” “investigative delay does not deprive [a defendant] of due process, even if his defense might have been somewhat prejudiced by the lapse of time.”<sup>115</sup> Consequently, claims of unreasonable prosecutorial delay have failed where the pre-indictment delay was due to DNA testing, such as when a defendant’s DNA profile matches a stored DNA profile from crime scene evidence years after the crime was committed.<sup>116</sup>

### 3.12.5 Discovery Issues

#### 3.12.5.1 *Brady Duty to Disclose Material Exculpatory DNA Evidence and Information*

In *Brady v. Maryland*, the U.S. Supreme Court held that the Due Process Clause of the Fourteenth Amendment requires the prosecution to disclose to the defense all material exculpatory evidence and information in the government's possession.<sup>117</sup> Courts have made clear that this *Brady* duty includes evidence and information possessed by the government's crime lab.<sup>118</sup>

Therefore, the government has a *Brady* duty to disclose any material exculpatory DNA evidence and any material exculpatory information about collection, testing, and storing of DNA evidence. This might include: flaws in the collection process or chain of custody; prior incidents of lab error; failed proficiency tests by lab technicians or analysts; inconclusive results; evidence of contamination; and DNA evidence from other crimes that might exonerate the accused in the case at hand.<sup>119</sup>

*Brady requires disclosure of any material exculpatory DNA evidence.*

The U.S. Supreme Court has also held, however, that *Brady* does not require the government to provide convicted defendants with access to the government's evidence so they may subject it to DNA testing.<sup>120</sup> In doing so, the high court noted that the federal government and forty-six States had already enacted statutes dealing with post-conviction access to DNA evidence.<sup>121</sup>

#### 3.12.5.2 *Government's Duty to Preserve Biological Evidence for Later Testing*

In *California v. Trombetta*, the U.S. Supreme Court held that the Due Process Clause of the Fourteenth Amendment requires the government to preserve material exculpatory evidence "of such a nature that the defendant would be unable to obtain comparable evidence by other reasonably available means."<sup>122</sup> Later, in *Arizona v. Youngblood*, the court clarified that unless the defendant can "show bad

faith on the part of the police, failure to preserve potentially useful evidence does not constitute a denial of due process of law.”<sup>123</sup>

Therefore, the government has a constitutional duty not to destroy any material exculpatory DNA evidence or any material exculpatory information about collection, testing, and storing of DNA evidence that the defendant may not obtain by other reasonably available means, but its failure to carry out this duty violates due process only if it acts in bad faith. Accordingly, courts have held that when government DNA testing would consume an evidentiary sample, the government is not required split the sample with the defense.<sup>124</sup>

### *3.12.5.3 Discovery in Criminal Cases Involving a NDIS DNA Match*

In cases involving DNA matches through NDIS, criminal defendants are entitled to access the DNA samples and analyses that were performed in connection with their cases.<sup>125</sup> The “hit file” of the U.S. Department of Justice’s DNA Data Bank Program generally includes:

- the hit notification letter that was issued by the database administrator to the DNA casework lab, including the name and state identification number of the offender whom the evidence profile matched;
- the specimen match detail report, specifying how many loci the profiles have in common and at which stringency;
- a photocopy of the offender’s sample submission card that was submitted with the offender’s buccal sample;
- chain of custody information, including the chronology of testing process;
- electropherograms for both the original and confirmation analyses;<sup>126</sup>
- procedural check sheets; and
- documentation of the technical and administrative review process.<sup>127</sup>

#### *3.12.5.4 Discovery in Criminal Cases Involving DNA Evidence*

Discovery is particularly important in cases involving DNA evidence because it may reveal concerns about the evidence's collection, transportation, storage, and testing. This section provides a brief overview of the items that are discoverable in most cases.

Rule 16 of the Federal Rules of Criminal Procedure establishes for prosecutors three disclosure responsibilities that may be relevant to forensic evidence:

1. the prosecution must permit a defendant to inspect and copy any results or reports of a scientific test that are (i) in the government's possession, custody or control, (ii) known or through due diligence could be known to a government attorney, and (iii) material to preparing the defense or intended to be used by the government in its case in chief at trial (rule 16(a)(1)(F));
2. the prosecution must provide, upon request, a written summary of any expert testimony the government intends to use during its case in chief at trial, including the expert's opinions, the bases and reasons for those opinions, and the expert's qualifications (rule 16(a)(1)(G)); and,
3. the government must produce, upon request, documents and items material to preparing the defense that are in the possession, custody, or control of the government, which may include records documenting the tests performed, the maintenance and reliability of tools used to perform those tests, and/or the methodologies employed in those tests (rule 16(a)(1)(E)).

Separately, the Quality Assurance Standards for Forensic DNA Testing Laboratories require participating labs to keep extensive records, which are subject to discovery.<sup>128</sup> For example, under Standard 11.2, a lab report must contain the following:

- case identifier;
- description of evidence examined;





- a description of the technology;
- locus or amplification system;
- results and/or conclusions;
- quantitative or qualitative interpretative statement;
- date issued;
- disposition of evidence; and,
- signature and title, or equivalent identification, of the person accepting responsibility for the content of the report.

Other required items that are subject to discovery include:

- documentation of the lab’s quality system manual (Standard 3)
- documentation of the lab’s evidence control system (Standard 7)
- documentation of the lab’s standard operation procedures (Standard 9)
- records of proficiency testing (Standard 13); and,
- documentation regarding corrective action when casework errors are detected (Standard 14).

Finally, chain-of-custody records, which document all transfers of DNA evidence—from collection to testing to the courtroom—are also discoverable. At a minimum, these records should include the locations where the evidence was stored and the names of anyone who had custody of the evidence, including those who:

- collected the evidence;
- sent and received the evidence to and from the police department and/or the lab;
- transported the evidence to and from the police department and/or the lab;
- logged evidence into and out of the evidence room.

### 3.12.6 Admissibility Issues

#### 3.12.6.1 Expert Testimony based on DNA Evidence: *Frye*<sup>129</sup> and *Daubert*<sup>130</sup>

An extensive discussion on these cases is found in *Section 7* in this Bench Book.

#### 3.12.6.2 Confrontation Clause Issues

The Confrontation Clause of the Sixth Amendment to the U.S. Constitution affords criminal defendants the right to cross-examine witnesses who offer testimony that serves as substantive evidence against them.<sup>131</sup> In *Crawford v. Washington*, the U.S. Supreme Court held that “[t]estimonial statements of witnesses absent from trial [may be] admitted only where the declarant is unavailable, and only where the defendant has had a prior opportunity to cross-examine.”<sup>132</sup> This holding raises two questions: whether DNA reports constitute “testimonial” evidence and whether the defendant has a right to cross-examine the analysts involved in production of the DNA report.

*Crawford* described “testimonial” evidence as “ex parte in-court testimony or its functional equivalent,” such as “affidavits, custodial examinations, prior testimony that the defendant was unable to cross-examine, or similar pretrial statements that declarants would reasonably expect to be used prosecutorially.”<sup>133</sup> Importantly, *Crawford* suggested that business records were not testimonial.<sup>134</sup> In *Melendez-Diaz v. Massachusetts* (2008) 557 U.S. 305, and *Bullcoming v. New Mexico*, 564 U.S. 647 (2011), the U.S. Supreme Court held that a lab’s sworn affidavit identifying as cocaine a substance seized from the defendant and a lab’s blood alcohol concentration (BAC) report of the alcohol content in a sample of defendant’s blood were testimonial evidence for purposes of the Confrontation Clause.<sup>135</sup> Together, these decisions hold that if a scientific report and its conclusions are offered for the truth of the matters they assert, as substantive evidence against a defendant, the analysts involved in the subject of the report are subject to confrontation.

In *Williams v. Illinois*, however, a divided U.S. Supreme Court held that an expert witness’s testimony about a non-admitted DNA report prepared by a non-testifying analyst did not violate the Confrontation Clause.<sup>136</sup> In that case, during the

defendant's trial for rape, one of the prosecution's expert witnesses testified that she had matched two DNA profiles: one produced by another testifying analyst from a sample of defendant's blood, and another produced by a non-testifying analyst at an outside lab. The trial court excluded the outside lab report in response to the defendant's objection that it had shown that the DNA profile provided by the outside lab was produced from semen found on vaginal swabs taken from the victim. Justice Alito, writing for a four-justice plurality, provided two, independent grounds for finding no constitutional violation. First, the testimony at issue was not admitted to prove the truth of the matters asserted, i.e., that the outside lab's report had shown that the DNA profile provided by the outside lab was produced from semen found on vaginal swabs taken from the victim.<sup>137</sup> Rather, it was offered to explain the basis for the expert's conclusion that the DNA profile produced from a sample of the defendant's blood matched the DNA profile provided by the outside lab.<sup>138</sup> Second, even if the other lab's report had been introduced for its truth, it would not constitute "testimonial" evidence for purposes of the Confrontation Clause, because unlike the forensic reports prepared in *Melendez-Diaz* and *Bullcoming*, it was not prepared for the primary purpose of creating evidence to use at trial to prove the guilt of a particular criminal defendant.<sup>139</sup> To this end, the plurality noted that lab technicians preparing DNA profiles "generally have no way of knowing whether it will turn out to be incriminating or exonerating--or both."<sup>140</sup>

Justice Thomas, writing only for himself, agreed with the plurality that the expert's statements were non-testimonial; in his view, the lab's report lacked the requisite "formality and solemnity."<sup>141</sup> Meanwhile, he agreed with the dissent that the expert's statements were offered for their truth and "share[d] the dissent's view of the plurality's flawed analysis."<sup>142</sup>

Therefore, it is unclear whether the prosecution is required call the analysts involved in the production of a DNA report in order to introduce it and its conclusions as substantive evidence against a defendant. In a recent dissent to a denial of certiorari, Justice Gorsuch, joined by Justice Sotomayor, noted, "This Court's most recent foray in this field, *Williams v. Illinois*, yielded no majority and its various opinions have sown confusion in courts across the country."<sup>143</sup>

### *3.12.6.3 Prejudice Concerns*

#### **(i) Presenting Evidence of DNA Database Matches**

Under Federal Rule of Evidence 404(b), evidence of a “crime, wrong, or other act” is not admissible to prove a person’s character in order to show that the person acted in accordance with that character on a particular occasion; but such evidence may be admitted for another, non-propensity purpose.

Concerns may arise when the prosecution presents evidence that a DNA profile created from crime scene evidence was matched to a defendant’s DNA profile in a DNA database. From the fact that the defendant’s DNA profile was stored in a DNA database, jurors may infer that the defendant was previously arrested or convicted of a crime and, therefore, has a propensity to engage in criminal conduct. Consequently, defense counsel have moved to suppress such evidence under rule 404(b) and its state equivalents.

Courts have rejected these motions on the ground that the evidence was introduced, not to show propensity, but to explain how the defendant became the suspect in the case and to avoid juror confusion.<sup>144</sup> It may be appropriate, however, for the trial court to issue a limiting instruction:

1. to prevent the prosecution from suggesting that the defendant’s DNA profile was in the DNA database as the result of prior criminal activity, and/or
2. to require the prosecution to elicit testimony that the DNA database contains DNA profiles from individuals who were not arrested or convicted of a crime.<sup>145</sup>

#### **(ii) Presenting Evidence of Inconclusive DNA Test Results**

Under Federal Rule of Evidence Rule 403, evidence that is relevant and otherwise admissible may be excluded if its probative value is substantially outweighed by a risk of unfair prejudice and/or misleading the jury. Such risks arise when DNA test results leave questions as to whether the defendant truly was the source of the DNA evidence—for example, when the defendant may not be excluded as a suspect, when



there is a relatively low statistical probability that the defendant contributed to the sample, or a relatively high statistical probability of a random match.

Generally, courts have found that such DNA test results are admissible, because their probative value is not substantially outweighed by their potential to cause unfair prejudice to the defendant or to confuse the jury.<sup>146</sup> In these cases, courts have stressed the “ameliorative potential of cross-examination, counter-experts, and clarifying jury instructions.”<sup>147</sup> But at least one court has reversed where inconclusive DNA test results were admitted without accompanying testimony explaining the statistical relevance of the results.<sup>148</sup>

### 3.12.7 Endnotes

1. District Attorney's Office for Third Judicial Dist. v. Osborne, 557 U.S. 52, 55 (2009).
2. MING W. CHIN ET AL., FORENSIC DNA EVIDENCE: SCIENCE AND THE LAW § 2.2 (The Rutter Group 2017).
3. *Id.*
4. *Id.* §1.1.
5. National Institute of Justice, *DNA Evidence: Basics of Identifying, Gathering and Transporting*, <https://www.nij.gov/topics/forensics/evidence/dna/basics/pages/identifying-to-transporting.aspx> (last visited Dec. 13, 2018).
6. CHIN ET AL., *supra* note 2, at § 1.1.
7. National Institute of Justice, *DNA Evidence: Basics of Identifying, Gathering and Transporting*, <https://www.nij.gov/topics/forensics/evidence/dna/basics/pages/identifying-to-transporting.aspx> (last visited Dec. 13, 2018).
8. CHIN ET AL., *supra* note 2, at § 1.1.
9. *Id.*
10. *Id.*
11. Before 2017, the FBI required that most profiles include 13 loci for inclusion its database. Effective January 1, 2017, the FBI increased the number of required loci to 20. (FBI, *Frequently Asked Questions on CODIS and NDIS*, <https://www.fbi.gov/services/laboratory/biometric-analysis/codis/codis-and-ndis-fact-sheet> (last visited Dec. 18, 2018))
12. CHIN ET AL., *supra* note 2 at § 2.3
13. *Id.* at § 1.1
14. Innocence Project, *Fast Facts: DNA Exonerations in the United States*, <https://www.innocenceproject.org/dna-exonerations-in-the-united-states/> (last visited Nov. 15, 2018).
15. Turpin v. Mobley, 502 S.E.2d 458 (Ga. 1998).
16. *Id.* at 466-467.
17. CHIN ET AL., *supra* note 2 at § 13.10.



18. *Id.*
19. Lori B. Andrews, *Genetics, Reproduction, and the Law*, 35 TRIAL 7 (July 1999).
20. Gary E. Marchant, *Genetic Susceptibility and Biomarkers in Toxic Injury Litigation*, 41 JURIMETRICS JOURNAL 67, 68 (2000).
21. *Id.*
22. *Id.* at 101.
23. *Id.* at 68.
24. *Id.* at 84.
25. *Id.* at 68-69.
26. CHIN ET AL., *supra* note 2 at § 13.10.
27. *Id.*
28. National Institute of Justice, *DNA Evidence: Basics of Identifying, Gathering and Transporting*, <https://www.nij.gov/topics/forensics/evidence/dna/basics/pages/identifying-to-transporting.aspx> (last visited Dec. 13, 2018).
29. *Id.*
30. *Id.*
31. Mary McCarthy, *Am I My Brother's Keeper?: Familial DNA Searches in the Twenty-First Century*, 86 Notre Dame L. Rev. 381, 392 (2011).
32. *Id.*
33. *Id.*
34. *Id.*
35. *Id.*
36. *Id.*
37. *Id.*
38. *People v. Nelson*, 43 Cal. 4th 1242 (Cal. 2008).
39. *Id.*; *See also* U.S. v. Jenkins, 887 A.2d 1013 (App. D.C. 2005)
40. *Id.*

41. *Id.*
42. *Id.*
43. *Id.*
44. *Combined DNA Index System (CODIS)*, FED. BUREAU OF INVESTIGATION, CRIM. JUST. INFO. SERV. (Dec. 5, 2018), <https://www.fbi.gov/services/laboratory/biometric-analysis/codis> (last visited Dec. 13, 2018).
45. *CODIS and NDIS Factsheet*, FED. BUREAU OF INVESTIGATION, CRIM. JUST. INFO. SERV. (Dec. 5, 2018), <https://www.fbi.gov/services/laboratory/biometric-analysis/codis/codis-and-ndis-fact-sheet> (last visited Dec. 13, 2018).
46. FED. BUREAU OF INVESTIGATION, CRIM. JUST. INFO. SERV., *CODIS - NDIS Statistics*, (Dec. 5, 2018), <https://www.fbi.gov/services/laboratory/biometric-analysis/codis/ndis-statistics> (last visited Dec. 13, 2018)
47. *CODIS and NDIS Factsheet*, *supra* note 43.
48. *Id.*
49. *Id.*
50. 34 U.S.C. § 12592 (b)(3) (situations in which DNA samples and DNA analyses may be disclosed).
51. 42 U.S.C. § 14132(b).
52. See FED. BUREAU OF INVESTIGATION, QUALITY ASSURANCE STANDARDS FOR FORENSIC TESTING LABORATORIES (2011) [hereafter *QAS for Forensic Testing Laboratories*] (available at <https://www.fbi.gov/file-repository/quality-assurance-standards-for-forensic-dna-testing-laboratories.pdf/view>); FED. BUREAU OF INVESTIGATION, QUALITY ASSURANCE STANDARDS FOR DNA DATABASING LABORATORIES (2011) [hereafter *QAS for DNA Databasing Laboratories*] (available at <https://www.fbi.gov/file-repository/quality-assurance-standards-for-dna-databasing-laboratories.pdf/view>).
53. *CODIS and NDIS Factsheet*, *supra* note 43.
54. *Id.*
55. *Id.*
56. *Id.*
57. *Id.*



58. See *QAS for Forensic Testing Laboratories and QAS for DNA Databasing Laboratories*, *supra* note 50.
59. Jason Kreag, Going Local: The Fragmentation of Genetic Surveillance, 95 B.U.L.Rev. 1491, 1492-1494 (Oct. 2015).
60. *Id.* at 1497, 1499.
61. *Id.* at 1496.
62. *Id.* at 1493.
63. U.S. CONST. Amend. IV (“The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated . . .”).
64. *U.S. v. Katz*, 389 U.S. 347 (1967).
65. *U.S. v. Jacobsen*, 466 U.S. 109 (1987).
66. *U.S. v. Mendenhall*, 446 U.S. 544, 553-54 (1980).
67. *Brigham City v. Stuart*, 547 U.S. 398, 403 (2006).
68. *Maryland v. King*, 569 U.S. 435, 446 (2013) (collecting cases).
69. *Id.* at 465-66.
70. *Id.* at 461-62, 465.
71. See *id.* at 445 (noting that all 50 states require the collection of DNA from felony convicts).
72. *Schneckloth v. Bustamonte*, 412 U.S. 218 (1973).
73. *Florida v. Jimeno*, 500 U.S. 248 (1991).
74. *Schneckloth*, 412 U.S. at 248.
75. *Jimeno*, 500 U.S. at 251.
76. *State v. Benefield*, 103 A.3d 990, 1000 (Conn. App. 2014).
77. *Varriale v. State*, 119 A.3d 924 (Md. App. 2015).
78. See *People v. Collins*, 250 P.3d 668 (Colo. App. 2010), *cert. denied* No. 10SC223, 2010 WL 4400041 (Colo. 2010) (Colorado’s matching of DNA sample from victim’s rape kit to defendant’s DNA profile did not exceed scope of consent where

defendant provided saliva sample in connection with robbery investigation in Missouri and then Missouri police sent defendant's DNA profile to Denver police because defendant did not place express limitation on his consent); *Com. v. Gaynor*, 820 N.E.2d 233 (Mass. 2005) (DNA testing did not exceed scope of consent where defendant provided blood sample with the understanding that it would only be used in comparison with blood samples from one crime scene and did not place explicit limitation on his consent); *Pace v. State*, 524 S.E.2d 490 (Ga. 1999), *cert. denied* 531 U.S. 839 (2000) (use of DNA profile in four separate investigations did not exceed scope of consent where defendant provided blood sample pursuant to consent form stating "for further use in this particular investigation" because defendant did not place explicit limitation on his consent). *But see State v. Gerace*, 437 S.E.2d 862 (Ga. App. 1993) (DNA testing exceeded scope of consent where defendant provided blood sample pursuant to implied consent law that limits the scope of implied consent to "determining alcohol or drug content").

79. *Com. v. Arzola*, 26 N.E.3d 185 (Mass. 2015), *cert. den.* 136 S.Ct. 792 (2016) (collecting unknown DNA sample from arrestee's item lawfully in government custody).
80. *U.S. v. Davis*, 690 F.3d 226 (4th Cir. 2012), *cert. den.* 571 U.S. 829 (2013).
81. *California v. Greenwood*, 486 U.S. 35 (1988).
82. *Williamson v. State*, 993 A.2d 626, 633-637 (Md. App.2010), *cert. denied*, 131 S. Ct. 419 (2010) (collecting DNA sample from pretrial detainee's saliva on McDonald's cup that he left on the floor of his jail cell); *Com. v. Perkins*, 883 N.E.2d 230 (Mass. 2008) (collecting DNA samples from suspect's saliva on two cigarette butts and a soda can that he left behind in interrogation room of police station after a voluntary interview); *State v. Athan*, 158 P.3d 27 (Wash. 2007) (en banc) (collecting DNA sample from suspect's saliva on envelope sent by suspect to police officers posing as class action lawyers).
83. *See Skinner v. Railway Labor Executives' Ass'n*, 489 U.S. 602, 619 (1989) ("[T]he collection and subsequent analysis of the requisite biological samples must be deemed Fourth Amendment searches").
84. *Maryland v. King*, 569 U.S. 435, 465 (2013)
85. *Davis*, 690 F.3d 226.
86. *Boroian v. Mueller*, 616 F.3d 60, 67-68 (1st Cir. 2010) (collecting authority in support of this proposition).

87. Compare *U.S. v. Kincade*, 379 F.3d 813, 841-42 (9th Cir. 2004), cert. den. 379 F.3d 813 (2005) (noting that individuals who have “wholly cleared their debt to society” have “substantial privacy interest at stake”) with *Johnson v. Quander*, 440 F.3d 489, 498-500 (D.C. Cir. 2006), cert. den. 127 S.Ct. 103 (2006) (rejecting argument that an individual’s reasonable expectation of privacy in his DNA sample is restored upon completion of probation).
88. See *State v. Blea*, 425 P.3d 385, 393 (N.M. Ct. App. 2018) [rejecting claim that placing burden on arrestees to seek expungement violates the Fourth Amendment]; *People v. Buza*, 4 Cal. 5th 658, 680-681 [noting, but not addressing, potential Fourth Amendment issues with California’s failure to provide for automatic expungement where charges do not result in felony conviction or convictions are overturned]; *Center For Genetics and Society et al. v. Becerra et al.*, CPF-18-516440, filed Dec. 10, 2018, in San Francisco Superior Court [asserting that California’s expungement procedures violate state constitutional right of privacy and prohibition against unreasonable searches and seizures].)
89. Maura Dolan & Jason Felch, *California Takes Lead on DNA Crime-Fighting Technique*, <https://www.geneticsandsociety.org/article/california-takes-lead-dna-crime-fighting-technique> (last visited December 27, 2018).
90. *Id.*
91. Religion & Ethics NewsWeekly, *Familial DNA Testing* <https://www.pbs.org/wnet/religionandethics/2008/05/16/march-6-2009-familial-dna-testing/66/> (last visited Dec. 13, 2018)
92. *Id.*
93. *Id.*
94. *Id.*
95. *Id.*
96. *Id.*
97. *Id.*
98. Ellen Nakashima, *From DNA of Family, a Tool to Make Arrests*, Wash. Post, Apr. 21, 2008, at A01 (last visited Dec. 13, 2018) [http://www.washingtonpost.com/wp-dyn/content/article/2008/04/20/AR2008042002388\\_pf.html](http://www.washingtonpost.com/wp-dyn/content/article/2008/04/20/AR2008042002388_pf.html); see generally Sonia M. Suter, All in the Family: Privacy and DNA Familial Searching, 23 Harv. J.L. &

- Tech. 309 (2010) (arguing familial searching should proceed with caution because it implicates significant privacy concerns).
99. Dolan & Felch, *supra*, note 84.
  100. Boroian v. Mueller, 616 F.3d 60, 69 (1st Cir. 2010).
  101. *Id.*
  102. Nakashima, *supra*, note 93.
  103. Joseph James DeAngelo, the so-called Golden State Killer.
  104. Justin Jouvenal, *To Find Alleged Golden State Killer, Investigators First Found His Great-great-great-Grandparents*, WASH. POST, (Apr. 30, 2018) [https://www.washingtonpost.com/local/public-safety/to-find-alleged-golden-state-killer-investigators-first-found-his-great-great-great-grandparents/2018/04/30/3c865fe7-dfcc-4a0e-b6b2-0bec548d501f\\_story.html?utm\\_term=.92432f4d9eb9](https://www.washingtonpost.com/local/public-safety/to-find-alleged-golden-state-killer-investigators-first-found-his-great-great-great-grandparents/2018/04/30/3c865fe7-dfcc-4a0e-b6b2-0bec548d501f_story.html?utm_term=.92432f4d9eb9)
  105. *See* Stogner v. California, 539 U.S. 607, 615-16 (2003).
  106. 18 U.S.C. § 3282(a).
  107. *See* 18 U.S.C. §§ 3281 (capital offenses), 3283 (child abuse and kidnapping); 3286 (terrorism).
  108. *See e.g.*, 18 U.S.C. §§ 3282(b), 3297.
  109. 18 U.S.C. § 3297.
  110. U.S. v. Hagler, 700 F.3d 1091, 1097 (7th Cir. 2012). U.S. v. Sylla, 790 F.3d 772, 775 (7th Cir. 2015).
  111. 18 U.S.C. § 3282(b); *see* 18 U.S.C.A. §§ 2241-48 (sexual abuse offenses).
  112. People v. Martinez, 52 A.D.3d 68 (N.Y.S. Ct. App. Div. 2008).
  113. State v. Yonage, 321 P.3d 1127 (Utah 2013); State v. Burdick, 395 S.W.3d 120 (Tenn. 2012); People v. Robinson, 47 Cal.4th 1104, 1133, 1140-43 (Cal. 2010) (collecting authorities in support of this proposition); Com v. Dixon, 938 N.E.2d 878 (Mass. 2010). *C.f.* State v. Belt, 179 P.3d 443 (Kan. 2008) (agreeing “in the abstract” that DNA-based John Doe warrants may satisfy particularity requirements, but dismissing three John Doe warrants that did not include unique DNA profiles of their subjects).
  114. U.S. v. Marion, 404 U.S. 307 (1971).

115. U.S. v. Lovasco, 431 U.S. 783, 795 (1977).
116. *See, e.g.*, Roberts v. State, 234 So.3d 1251, 1268-69 (Miss. 2017); Com. v. Dame, 45 N.E.3d 69 (Mass. 2016); People v. Cordova, 62 Cal. 4th 104, 118-20 (2015); U.S. v. Hagler, 700 F.3d 1091, 1098-1100 (7th Cir. 2012); State v. McGuire, 786 N.W.2d 227 (Wisc. 2010); Graham v. Com., 319 S.W.3d 331, 341-42 (Ky. 2010); People v. Nelson, 43 Cal. 4th 1242, 1249-57 (2008); State v. Montano, 65 P.3d 61 (Ariz. 2003); Clark v. State, 774 A.2d 1136 (Md. App. 2001).
117. Brady v. Maryland, 373 U.S. 83 (1963).
118. In re Brown, 17 Cal. 4th 873 (1998) (*Brady* violation where prosecution failed to disclose to capital defendant the positive results of a drug test, despite the fact that the crime lab did not inform the prosecution of such results); U.S. ex rel. Smith v. Fairman, 769 F.2d 386 (7th Cir. 1985) (*Brady* violation where prosecution failed to disclose to the defendant information that the defendant's firearm was non-operable, despite the fact that the crime lab did not inform the prosecution of such information).
119. U.S. DEP'T OF JUSTICE, OFF. OF JUSTICE PROGRAMS, NCJ 237975, DNA FOR THE DEFENSE BAR, at 31 (2012).
120. District Attorney's Office for Third Judicial Dist. v. Osborne, 557 U.S. 52 (2009).
121. *Id.* at 62-63.
122. California v. Trombetta, 467 U.S. 479, 489 (1984).
123. Arizona v. Youngblood, 488 U.S. 51, 58 (1988).
124. United States v. Kingsbury, 317 F.Supp.3d 476, 478-79 (D.D.C. 2018) (collecting cases); State v. Ferguson, 20 S.W.3d 485, 496 (Mo. 2000), *cert. denied* 531 U.S. 1019 (2000).
125. 34 U.S.C. § 12592 (b)(3)(C).
126. An electropherogram is a graphic representation of the separation of molecules by electrophoresis or other means of separation.
127. CHIN ET AL., *supra* note 2 at § 10:5.
128. See FEDERAL BUREAU OF INVESTIGATION, QUALITY ASSURANCE STANDARDS FOR FORENSIC TESTING LABORATORIES (2011), <https://www.fbi.gov/file-repository/quality-assurance-standards-for-forensic-dna-testing-laboratories.pdf/view> (last visited Dec. 13, 2018).



129. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).
130. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).
131. U.S. CONST. Amend. IV (“In all criminal prosecutions, the accused shall enjoy the right ... to be confronted with the witnesses against him.”).
132. *Crawford v. Washington*, 541 U.S. 36, 59 (2004).
133. *Id.* at 51–52.
134. *Id.* at 56.
135. *Bullcoming v. New Mexico*, 564 U.S. 647 (2011) (blood alcohol concentration (BAC) report); *Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009) (lab’s sworn affidavit identifying substance as cocaine).
136. *Williams v. Illinois*, 567 U.S. 50 (2012).
137. *Id.* at 70-71.
138. *Id.* at 57-58.
139. *Id.* at 84-86.
140. *Id.* at 85.
141. *Id.* at 103 (Thomas, J., concurring in part and concurring in judgment).
142. *Id.* at 104, 108-09.
143. *Stuart v. Alabama*, 139 S.Ct. 36 (2018) (Gorsuch, J., dissenting) (citation omitted).
144. *See e.g.*, *Scales v. State*, 712 S.E.2d 555, 561-562 (Ga. Ct. App. 2011) (testimony was relevant to explain “why this fourteen year old case is now being prosecuted and how the investigation came to focus on the Defendant”); *People v. Harland*, 251 P.3d 515, 517 (Colo. App. 2010), *cert. denied* No. 10SC563, 2011 WL 51758 (Colo. 2011) (testimony was relevant because “it explained how defendant became a suspect after scores of leads had not panned out over several months, an important point because (1) absent the explanation, the jury would be left to speculate as to how defendant became a suspect, and (2) defendant’s defense was mistaken identity”); *Whatley v. State*, 146 So.3d 437 (Ala. App. 2010), *cert. denied* 135 S.Ct. 90 (2014); *State v. McMilian*, 295 S.W.3d 537 (Mo. App. 2009) (testimony was “necessary to explain the significant passage of time between the offense and McMilian’s identification”); *People v. Jackson*, 903 N.E.2d 338 (Ill. 2009) (testimony was “necessary to explain how defendant came to be identified as the



source of the DNA recovered at the crime scene”); *Atteberry v. State*, 911 N.E.2d 601, 609 (Ind. App.2009) (testimony was relevant “to show why Atteberry, living in St. Louis, was a suspect in an Indianapolis murder”).

145. *See, e.g.*, *Scales*, 712 S.E.2d at 561; *McMilian*, 295 S.W.3d at 539; *Atteberry*, 911 N.E.2d at 609.
146. *See, e.g.*, *State v. Lang*, 954 N.E.2d 596, 618 (2011) (affirming admission of DNA test results where random match probability was 1 in 3,461); *United States v. Graves*, 465 F. Supp. 2d 450, 457-59 (E.D. Pa. 2006) (admitting results DNA test results re: DNA evidence on sneakers where random match probability of 1 in 2,900 to 1 in 3,600, but excluding DNA test results re: DNA evidence on an umbrella where random match probability was 1 in 2); *Commonwealth v. O’Laughlin*, 843 N.E.2d 617, 633 (Mass. 2006) (affirming admission of DNA test results where the random match probability was 1 in 2); *U.S. v. Morrow*, 374 F. Supp. 2d 51, 62-66 (D.D.C. 2005); (affirming admission of DNA test results where random match probability ranged between 1 in 1 and 1 in 12); *U.S. v. Hicks*, 103 F.3d 837, 844-47 (9th Cir. 1996), *cert. den.* 520 U.S. 1193 (1997), *partially overruled on other grounds by U.S. v. W.R. Grace*, 526 F.3d 499 (9th Cir. 2008) (en banc) (affirming admission of expert’s testimony that DNA testing could not exclude defendant as a possible contributor to a DNA sample from a vaginal swab).
147. *Morrow*, 374 F. Supp. 2d at 68; *see also Graves*, 465 F. Supp. 2d at 459.
148. *Commonwealth v. Mattei*, 920 N.E.2d 845, 848 (Mass. 2010) (trial court erred in admitting “expert testimony that DNA tests could not exclude the defendant as a potential source of DNA found at the crime scene, absent testimony regarding statistical findings explaining the import of such a result”).

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# 4. INTRODUCTION TO STATISTICAL THINKING FOR JUDGES

Sections 4.1 - 4.9

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**ERYN BLAGG<sup>1</sup> &  
ALICIA CARRIQUIRY,<sup>2,3</sup> PhD**

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## 4.1 WHAT IS STATISTICS?

Statistics is the science of collecting, analyzing and interpreting data. Statisticians develop, test and implement tools to display empirical data, to extract information from those data, and more generally, to draw inferences about populations using samples drawn from populations. Data arise in every discipline, so statistical methods are useful to almost everyone who wishes to use data to answer questions. The civil and criminal justice systems are no exceptions. Questions of interest might include:

- What was the time of death of the victim?
- Did the suspect's shoe leave the print at the crime scene?
- Are hiring practices in company X discriminatory?
- Is the defendant the father of the child?

*Statistics is the science of collecting, analyzing and interpreting data.*

These are just a few examples of the many questions that may arise in court, and for which the judge or a jury must produce an answer. Ideally, the answer is accompanied by some measure of *uncertainty* to reflect the confidence of the juror or judge on the answer. The idea of uncertainty plays a critical role in statistics. Uncertainty arises when we do not know the outcome of some process, yet decisions must be made in the face of uncertainty. Evidence may suggest the defendant committed the crime, but unless we were there to see the crime in real time, there is always some chance someone else may have been guilty instead. Statistics provides the means to address

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these types of questions and to produce an estimate of confidence around the answers. In order to do this, statisticians make use of mathematical and computational tools.

The rest of the chapter will expand on some important statistical topics. We start by defining some basic ideas of statistics, including populations and samples, then move on to talking about the different types of data that may arise in the context of legal proceedings. Next, we discuss various approaches to collecting data and talk about the design of studies, including how those factors affect the type of inference that can be drawn. Following that, we talk about describing and summarizing sample information, and present some key ideas associated with statistical inference, or making conclusions about a population using information from a sample. We finish by briefly discussing how to assess the quality of the data arising from a sample or from a study, and of the study itself. We close with a summary of key issues.

## 4.2 PROBABILITY, STATISTICS AND DATA

### 4.2.1 Populations and Samples

When data are used in the courtroom, it is important to establish where the data came from. The data may come from a *sample* of a population, or in rare cases, may include the entire population. The latter happens infrequently because, unless a census is conducted, the complete population of interest is rarely known. Depending on whether data comprise the population, or only a subset of the population (sample), the statistics and statistical analysis that is used are different. Thus, the first step is to determine whether we are working with a population or with a sample.

A *population* is the universe of objects of interest. In the legal context, a population may be every promotion decision made by every manager of a large employer in California, it may be the outsole pattern of every shoe sold in the United States last year, or perhaps every baggy containing some white powder in a container arriving from Asia. Sometimes, the population of interest is a sub-set of the larger population. For example, we may be interested in promotions only among entry-level employees in California. It is important to clearly state what is the population of interest in every case.

A *sample* is a set of objects obtained from the population that are available to us for study. In practice, populations can be large, and it can be impractical, or even impossible, to take measurements on each population object. In the case of the container or baggies, we may select a small number upon which to carry out a chemical test. The goal of a sample is to represent the population without having to test every single baggy in the container.

The tools of *probability* allow us to anticipate what we might observe in the sample. For example, if we know a dice is fair, we can anticipate we will obtain an even number in about half of the rolls. In other words, if we know the probabilities associated with the various possible outcomes from the population, we can *deduce* what we will observe in a sample from the population. The tools of statistics on the other hand, are *inductive*, i.e., we make inferences about the population using what we observe in a sample from that population. For example, we infer that among Caucasians, the gene allele 15 at locus D3S1358 is present on the chromosome of 24.6% of the population.<sup>4</sup> Of course,

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a genotypic test was not implemented on every possible Caucasian person in the world to reach this conclusion. Instead, this inference was based on the information obtained from a relatively small (in the thousands) sample of Caucasian persons whose DNA was analyzed.

### 4.2.2 Probability

Probability is invoked often in court cases, from the probability the company in question is discriminatory to chances the gun found on the suspect was the source of the bullets from the crime scene. Different types of probability statements have different interpretations. It is important to distinguish what kind of probability statement is being made in order to make sure the interpretation is correctly presented. When dealing with probability statements from an expert witness, it is imperative to determine if the interpretation matches the relationship being addressed.

Probabilities describe how often an event is likely to occur; *odds* are a ratio of these probabilities. When working with probabilities it is important to determine if the event is conditional upon another event. *Conditional probabilities* give us a way to calculate probabilities of an event “A” given that another event “B” has occurred. For *independent events*, the probability of A is unchanged whether or not B occurs, whereas for dependent events, *Bayes’ theorem* can be used to switch between event “A” given “B” and event “B” given “A”. In this section, we will describe the different types of probability statements and the interpretation that corresponds to each.

*Probability is the mathematical language of uncertainty. The probability of an event is a number between 0 and 1 that reflects the likelihood that an event occurs.*

#### 4.2.2.1 What is probability?

*Probability* is the mathematical language of uncertainty. The probability of an event is a number between 0 and 1 that reflects the likelihood that an event occurs. Examples of events include:

- A fair die lands on a 6.
- A randomly chosen baggy from the container contains fentanyl.
- The Chicago Cubs win the World Series.

An event with probability of 1 always occurs. An event with a probability 0 never occurs. In most cases, the event probability is somewhere in that interval, i.e., between 0 and 1.

#### 4.2.2.2 *Where do probabilities come from?*

There are different interpretations of probability, but the two most widely accepted are what are known as the *long-run frequency* interpretation and the *subjective belief* interpretation. The long-run frequency interpretation, as the name suggests, establishes the probability of an event by the frequency with which the event occurs in a very large number of trials. For example, if we toss a fair coin a million times, the probability of heads is estimated as the proportion of tosses resulting in a head. This frequency interpretation of probability is reasonable when the “experiment” (e.g., the coin toss) is repeatable. The *subjective belief* interpretation refers to the expected likelihood an event will occur. This interpretation can be applied in those cases where repeating a trial is not possible. As an example, we might believe the Cubs have a 0.7 chance of winning the World Series. Subjective beliefs can be informed by empirical data or other information. Since there is only one 2021 World Series, we cannot use replication, and must use other methods for determining subjective beliefs. My personal probability the Cubs will win the World Series may be based on the results of pre-season games, on my knowledge of the players that the Cubs have and on information about team injuries. In this sense, the term “subjective” does not necessarily mean “arbitrary.” When an expert in court presents a subjective probability, he or she should also describe the information used to establish that probability.

#### 4.2.2.3 *Probability and odds*

We often talk about the odds of something occurring. For example, the odds we will win the lottery are negligibly small. The odds two DNA samples will match if they belong to the same person are very high. *Odds* are simply ratios of probabilities; they are not

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probabilities. The odds in favor of event “Y” is defined as the probability that event “Y” occurs divided by the probability that event “Y” does not occur.<sup>5</sup>

Similarly, the odds against “Y” is defined as the ratio of the probability that “Y” does **not** occur to the probability that it does. If we are given the odds for or against an event, then we can derive the probability of the event.

Although probabilities and odds are related to each other, their interpretation is different. For example, if the probability of an event is 0.5, we have odds  $0.5/0.5=1$ . As the probability increases, the odds get larger and larger. For example, for an event with probability 0.99, the odds in favor of the event are  $0.99/0.01=99$ .

### 4.2.2.4 Conditional probability

The concept of *conditional probability* arises often in the legal context but must be distinguished from the concept of probability as described above. Consider a pathologist trying to determine how long ago a victim died. Based on the body’s temperature, the

*When dealing with conditional probabilities, it is important to be certain we have accounted for the relevant events.*

pathologist concludes the victim died between 18 and 20 hours ago, with probability 0.9.<sup>6</sup> The detective tells the doctor that the victim appears to have been killed outside, and the ambient temperature was 30 degrees Fahrenheit at the time the body was found. Would the pathologist revise the probability? Given the body was outside, it is likely its temperature decreased faster than the pathologist had estimated earlier when there was no information about the body’s location. With the additional information, the pathologist may now decide

the probability the victim died between 18 and 20 hours ago, given that the body was outside, is no larger than 0.2.<sup>7</sup>

Conditional probability changes the population to which we refer. When the doctor did not know where the victim was found, the relevant population was all cadavers. With the additional information, the new relevant population is only those cadavers subject to temperatures around freezing. When dealing with conditional probabilities, it is important to be certain we have accounted for the relevant events. From the example above, the probabilities of an event occurring changes drastically depending on the conditioning



event, i.e., the temperature where the body was located. It is usually the case that inverting conditional probabilities leads to different results. Because of this, we need to be careful about both identifying the population of interest and including the relevant information about the population.

Another example to illustrate the point: suppose we have 300 pairs of 9mm bullets, 200 of which were fired from the same gun and 100 of which were fired by different guns. For each pair, we measure the number of consecutively matching striae or CMS (a quantitative method of describing an observed pattern match) and find that:

	NUMBER OF CMS								Total
	1	2	3	4	5	6	7	8	
Same Gun	0	5	11	21	32	40	49	42	200
Different Gun	6	12	29	32	10	9	2	0	100
Total	6	17	40	53	42	49	51	42	300

TABLE 4.1 NUMBER OF CMS BY SOURCE OF BULLETS<sup>8</sup>

The probability of observing 6 CMS in this study is  $\Pr(\text{CMS}=6) = 49$  divided by 300 which is 0.16. However, when we look at the conditional probability, the probability that CMS is 6, given that bullets were fired by the same gun is higher, viz. 40 over 200 or 0.20. In the first case, the population of interest were all pairs of bullets; in the second case, we restricted interest to the population of pairs of bullets fired by the same gun.

*Conditional probabilities occur often in the legal and forensic context, and it is important to differentiate them from other forms of probability statements.*

The inverted conditional corresponds to a different question: Given I observe that CMS is equal to 6, what is the probability the bullets were fired from the same gun? Now we have  $40/49 = 0.82$ . This is one of the reasons why it is important to ascertain the specified population to be used, based on the question being asked. We will see later in this section that the “likelihood ratio” is a ratio of two conditional probabilities, but for now realize conditional probabilities occur often in statistics and it is important to differentiate them from other forms of probability statements.

### 4.2.2.5 *Conditional probability and independence*

Sometimes, additional information does not change the probability of an event. This is referred to as *independence*. Suppose in addition to CMS, we also know the firearms examiner was born in Texas. This additional piece of knowledge does not change the probability of observing 6 CMS given that the bullets were fired by the same gun. We say that the place of birth of the examiner is independent of the number of CMS, so the probability of observing a 6 is still 0.16. as before. When two events are independent, the probability that both events occur simultaneously (or jointly) can be computed using the *product rule*: if events A and B are independent, then their *joint probability* is the probabilities of the two events multiplied together.<sup>9</sup>

A well-known example of independent events in the legal and forensic context is the independence of DNA markers located on different chromosomes. This is one of the reasons there is a low probability that two humans share the same alleles at the loci typically used in forensic genotyping. To illustrate, consider two DNA markers, D3S1358 and vWA. Assume that the sample from a crime scene has alleles 16,16 and 15,17 at each locus, respectively. What, then, is the probability of that particular genotype at the two loci? From published allelic frequency tables,<sup>10</sup> we know the probability that a Caucasian person is homozygous 16,16 at the D3S1358 locus is 0.0943 and the probability a Caucasian person has genotype 15,17 at the vWA locus is 0.0866. The probability that a Caucasian person will match the crime scene sample at both loci can then be calculated. Using the product rule, and our knowledge of independence of DNA markers located on different chromosomes, we have  $0.094 \times 0.0866$  or 0.0082. Thus, only about 8 in 1000 Caucasian persons would be expected to match the crime scene sample at both markers. In forensic DNA analysis, scientists examine the genotype at 21 loci. Then, to compute the probability of a match, they apply the product rule using the 21 published allelic frequencies corresponding to the observed genotype. This is how negligibly small match probabilities, perhaps in the order of 1 in a trillion, are obtained and why DNA evidence is so probative.

### 4.2.2.6 *CONDITIONAL PROBABILITY AND BAYES' THEOREM*

When events A and B are not *independent*, typically the probability of event “A” given event “B” is not the same as event “B” given event “A”. *Bayes' Theorem*<sup>12</sup> tells us how to “invert” the conditional and go from the probability of event “A” given event “B” to

the probability of event “B” given “A” in such instances. If the probability of event “A” and the probability of event “B” are known, then one can find the probability of event “A” given “B” by taking the probability of “B” given “A” times the probability of “A”, then dividing by the probability of “B”. More generally, it allows us to use information in a sample to make inferences about a population given that we know the probabilities of both “A” and “B”.

For example, assume you leave work one day having a sore throat and a headache. You remember that last week one of your coworkers had strep throat. Does this mean you now have it? You know that 95% of people afflicted with strep throat have both a sore throat and headache as symptoms. After some “Googling” you find that about 5% of people in your location get strep every year, but also that about 30% of people experience sore throats and headaches without suffering from strep throat. Using this knowledge, and Bayes’ Theorem, you can find the probability that, given you exhibit the symptoms, you have strep throat. That is, taking the probability that someone has a sore throat

*Conditional probabilities get reversed in Court so often that this mistake has a name: the prosecutor’s fallacy.*

and a headache, given they have strep, multiplied by the percentage of people in your location who get the virus each year, then dividing by the percent of people who have headaches and a sore throat without being sick, we get the probability that you have strep given you have the symptoms:  $0.95 \times 0.05 / 0.3 = .158$ . So, the probability you have strep, given you have the symptoms, is about 16%.

Note that the probability of strep throat given the symptoms (16%) is very different from the probability of symptoms given strep throat (95%). Also note, that in order to go from probability of symptoms given strep throat to probability of strep throat given symptoms, we need two additional pieces of information: the background probability of strep throat and the background probability of the symptoms in the population.

Conditional probabilities get reversed in Court so often that this mistake has a name: the *prosecutor’s fallacy*. The prosecutor’s fallacy occurs when the following two probabilities get equated: the probability of observing the evidence if the suspect is innocent, and the probability that the suspect is innocent given the evidence we have observed. For example, suppose that a witness reports seeing a blond woman with a



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ponytail and with only one arm at the crime scene. Further, suppose that the prosecution argues that only one in one ten thousand women in the surrounding areas is blond, wears a ponytail and has a single arm. Even if the suspect is a blond woman who is missing an arm, it is still incorrect to conclude that the probability that she is not the criminal is only one in ten thousand.

## 4.3 FROM PROBABILITY TO STATISTICAL INFERENCE: COLLECTING DATA

In order to develop, test and validate instruments and other technologies, or to assess the value of forensic evidence in general, it is necessary to collect *data*. The type and quantity of data we collect determines the type of information we can extract from the data, so it is important to think carefully about the provenance of the data upon which we rely. Statisticians have important knowledge to contribute when it comes to data collection. In this section, we describe two fundamental approaches for data collection—experimentation and sampling—and discuss the uses and limitations of the resulting information. Before we address study design issues, we first talk about the types of data that can be collected.

The two types of data are qualitative and quantitative. Qualitative data refers to data that have different categories; these can be ordinal or not. Quantitative data describes numeric data on a continuous or discrete scale. Depending on the type of data being used, different statements and analysis can be made. Thus, when working with data, the first step is always to determine the type of data we have. In order to collect data, either experimental or sampling studies must be performed. The most common goals of both types of studies are to collect a random and representative sample, even if the mechanisms are quite different. If those two goals are not accomplished, then one cannot generalize about the population from the data. With sampling, there are always some shortcomings, which may skew any results that come from the data.

### 4.3.1 Types of Data

Statisticians distinguish between various types of data:

- *Qualitative data* represent attributes of an object such as gender, color, zip code or genotype. We distinguish between two types of qualitative data:
  - *Categorical*, where there is no ordering of the categories. An example is blood type, which have values A, B, AB, or O.



- *Ordinal*, where there is a natural ordering of the categories. An example is the response to a question in a judicial survey that may take on values between 1 and 5, with 1 being “strongly disagree” and 5 being “strongly agree”. The assignment of ordinal categories is sometimes arbitrary. It is important to realize that, although ordinal categories are numeric, one cannot take the average, i.e., the *mean*, and assign it meaning. The mean of the responses to two questions in a survey, one being 1=strongly disagree, and the other being 5= strongly agree, in a survey does not mean the judge has average views, but rather that the judge has very different responses for the two questions.
- *Quantitative data* typically arise as the result of some measurement process and is expressed in numerical values. These values normally have units as well, such as inches, years, or miles. Again, we distinguish between two types of quantitative data:
  - *Discrete*, where the measurements can take only integer values, i.e., whole numbers. Examples include the number of consecutively matching striae or CMS, or the number of children in a family.
  - *Continuous*, where the measurements can take on an infinite number of different values in some range. An example is the concentration of some chemical element in a glass fragment.

Different types of data call for different types of statistical analyses, as we will discuss later. Before we think about statistical analyses, we briefly discuss the two fundamental data collection paradigms.

### 4.3.2 Collecting Data Via Sampling Studies

Unless we are dealing with a small population of interest, we must use sampling, because it is typically too costly, or too time consuming, to study the entire population. Sampling simply consists in selecting – in some principled way – a sub-set of the objects in the

population. The idea behind sampling is simple: We attempt to draw a sub-set of the population that looks enough like the population itself, so that the results of statistical analysis using measurements from the objects in the sample are generalizable to the population itself.

There are two major types of sampling approaches: 1) Those based on some random selection of the objects in the population, and 2) Those that select objects using some systematic (non-random) approach. The samples that result from random sampling are called *probability samples*. There are different types of probability samples. Three commonly used sampling methods are:

*Sampling simply consists in selecting – in some principled way – a sub-set of the objects in the population.*

- *Simple Random Sampling*: Characterized by the idea that every member of the population has an equal chance of being selected for the sample.
- *Stratified Random Sampling*: Often large populations will be made up of smaller homogenous groups. We may want to make sure each group is represented in the sample. For a population which can be divided into strata, a stratified random sample is a sample which is obtained by drawing random samples from each stratum. Often, the number of items sampled from each of the strata corresponds to the size of the stratum. When sampling glass fragments for analysis, for example, we might stratify glass into architectural, automotive, and other.
- *Cluster Sampling*: Similar to a stratified random sample, a population can be separated into clusters. A cluster sample is obtained by randomly selecting a number of clusters and sampling each member in those selected clusters. Population surveys often use cluster sampling. For example, a city block is a cluster and a resident in every household in the block is then included in the sample. In the legal context, the population may consist of 1000 containers arriving from abroad in a month, each filled with boxes supposedly containing stuffed toys. Each container is a cluster,

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and a reasonable sampling approach might be to select a sub-sample of the containers and from each, inspect every box.

*Non-probability* samples are used extensively in qualitative research and the social sciences. They can be useful in studying some social phenomenon in depth. They are also used when implementing a *bona fide* random sampling method is impractical, as in the case of sampling populations that do not wish to be found such as drug users or undocumented migrants. Three commonly used approaches for non-probability sampling are:

- *Convenience sampling*: Occurs when the investigator selects objects from the population that is most handy. An example would be a study where we sample only co-workers, or patrons in a mall.
- *Snowball or network sampling*: These types of samples are useful when members of the population of interest do not identify themselves as such. This might include, for example, users of illegal substances, under-age drinkers, or HIV-positive persons. Network sampling consists of finding one or a few members of the population and then using their connections to continue building the sample.
- *Purposive sampling*: In this type of sampling, the data collector selects the objects to be included in the study using some selection criterion. This type of sampling is sometimes implemented when the attribute to be studied is very expensive to measure and the researcher cannot afford to measure it in a large sample. An example might be measuring the effect of exposure to a pesticide on the functioning of the brain of persons exposed. In this type of study, the researcher may select a small number of agricultural workers for example in a limited number of farms known to have low, medium and high exposure to the pesticide of interest.

It is always important to understand how the sample was selected in order to be sure that the statistical findings obtained from the sample are generalizable, and if at all, to the population of interest. For example, suppose that in a study of gun ownership in the US we purposively select 100 counties from which to collect information. Even

if the individuals sampled within each of the counties comprise a probability sample, results will be generalizable only to the 100 counties included in the study. If instead the 100 counties are also randomly selected from the 3,141 counties in the US, then results are generalizable to the entire country.

*Probability sampling* is the gold standard and should be used whenever we wish to make statistical inferences about the population from which the sample was drawn. However, not all probability samples allow unbiased and reliable inference about the population. Probability samples are obtained by applying some form of random selection of items from a population.

Regardless of the selection method, the important idea is that each member of the population has a known probability of selection. In a simple random sample, defined above, each population item has a probability of selection that is equal to  $1/N$ , where  $N$  is the size of the population, and all possible samples of the same size also have a known and equal probability of selection. In the usual classroom example, if I have a bag with 100 identical balls labeled 1 to 100, the ball numbered 57 has a probability of selection of  $1/100$ .

*Probability sampling is the gold standard and should be used whenever we wish to make statistical inferences about the population from which the sample was drawn.*

*It is always important to understand how the sample was selected in order to be sure that the statistical findings obtained from the sample are generalizable, and if at all, to the population of interest.*

For the sample to be representative of the population, a simple random sample may need to be very large. Suppose that we wish to test a new risk assessment tool for predicting recidivism. The tool's performance is likely to depend on individual attributes, including gender, race, age, and offense type. If we consider two genders, five races, four age categories and six different offense categories, that results in  $2 \times 5 \times 4 \times 6 = 240$  different combinations, some of which may be rare. In order for the sample to include at

least a few cases in each of the categories of interest, so that it is representative of the population, the sample size would need to be enormous.





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To illustrate, assume a rare category comprises 0.1% of the population of criminals. To include at least one case, the sample would need to be at least of size 1000, and even then, there is a sizeable chance that the simple random sample would not include this combination of attributes. This is a case in which a more effective random sampling approach might be a stratified random sample consisting of strata made up of the different combinations of criminals by sex, age, etc., and then randomly selecting a certain number of cases from within each of those strata. Of course, the resulting sample would not be representative of the population because it would include a higher proportion of the rare cases than exist in the population. But if the selection probability of each sampled person is known, then statisticians can construct survey weights for each sampled person or object so that, after weighting, the sample is once again representative.

The biggest difference between probability and non-probability sampling is that, in probability samples, each sampled object has a known probability of selection, whereas in non-probability sampling, the probability of selection of each item in the population is unknown. In fact, non-probability sampling is often used when we do not even know the size or the composition of the population of interest. Consequently, probability samples allow us to make inferences about the population from which the sample was drawn, but non-probability samples most often do not. There are many different approaches for selecting random samples from large, complex, populations, but as long as the design of the sample or survey is known and the probability of selection of each population item is also known, it is always possible to ensure that the results of analyzing the sample measurements will generalize to the population.

### 4.3.3 Potential Shortcomings of Sampling

Probability samples are not without issues. Some of those issues include:

- *Incomplete coverage/Undercoverage*: This occurs when a proportion of the population is not represented or is underrepresented. A famous example of this was the political survey carried out by the Gallup organization when Dewey and Truman were running for President of the United States in 1948. Gallup used a method called *quota sampling*, where the idea is to create a sample that equals the population in terms of proportion of genders, races, rural/urban living and so on. Inevitably, some



population attributes that affect voting preferences are left out. Famously, Gallup predicted Dewey would defeat Truman by a large margin, but Truman ended up winning.



IMAGE 1: TRUMAN SHOWING THE HEADLINE OF THE CHICAGO TRIBUNE THAT, FOLLOWING GALLUP'S FORECAST, HAD MISTAKENLY ANTICIPATED A WIN BY DEWEY<sup>13</sup>

- *Self-selection bias*: Samples that consist of participants who self-select for the survey/study are typically not representative of the population. Self-selection occurs when individuals have a choice of whether to participate in the survey. Examples include surveys carried out by a company such as Survey Monkey on behalf of a client.
- *Non-Response Bias*: People selected for the sample may decide not to participate. Well-designed surveys aim for a sample size large enough to guarantee desirable precision of sample estimates. When non-response is higher than designers anticipated, the resulting estimation error is larger than desired. If, in addition, the non-response is not uniform across all respondent types, then the estimates obtained from the sample can be biased, in addition to exhibiting high error. As an example, suppose we are surveying crime labs to find out about their backlog in cases. The sample was designed so it would be representative of the population of crime labs of a certain size. Now, imagine only the small sized labs respond to the survey. The likely outcome is we would be under-

estimating the size of the backlog because the sample included no medium-sized or large labs.

- *Response bias*: Response bias occurs because, although a subject may agree to respond to a survey, he or she may not always tell the truth. For example, a worker might not tell her boss how she feels about his actions because of fear of how it may impact her job.

This is not an exhaustive list of the problems that may afflict samples. However, it does include the most commonly observed poor sampling practices, and issues that one should be aware of, as they can strongly impact the quality of the findings obtained from the selected data. One last comment is that when samples are drawn for the purpose of eliciting a political opinion, they are often called “polls.” This is just another name for a sampling study or survey. Just like any other survey, polls can be well designed and conducted, or not.

### 4.3.4 Observational Studies versus Randomized Experiments

Statisticians and other scientists may collect data to compare “treatments” in order to answer a question or test a theory. The two most common types of designed studies are “observational” and “randomized” studies.

*Observational studies* are studies in which the researcher has no control over the experimental units, or what/who is receiving the treatments. Observational studies are seen frequently when looking at the health effects of exposure to a chemical or the consequences of implementing a new policy. In this type of study, we attempt to establish the effect of exposure to a substance by sampling individuals from populations that were, and were not, exposed then measuring the prevalence of the health outcome of interest. This method of experimentation has its limitations, however. There may be factors contributing to a disease other than exposure rates. For example, the exposed population may live near a polluting site, and consequently be poorer and have worse access to health providers, than those

*Observational studies are studies in which the researcher has no control over the experimental units, or what/who is receiving the treatments.*

who live in “clean” areas. As a result, the type of inference that can be drawn from observational studies is limited. We might find, for example, that higher exposure is associated with higher prevalence of the disease, but we cannot establish a *causal relationship* between the two.

Despite this limitation, observational studies are often used when traditional studies are not an option because, ethically or logistically, we would be unable to assign individuals to treatments we know (or suspect) will be harmful to them. For example, it would be unethical to assign participants to a smoking group (if they do not already smoke) to study the relationship between cigarettes and cancer. Similarly, if we wish to understand the relationship between race and probability of a traffic stop, it is not logistically possible to reassign, i.e., change, a person’s race.

*Randomized studies* are the gold standard of experiments. In a randomized trial, participants are randomly assigned to treatments. The random assignment ensures that all other differences between participants, both observed and unobserved, are balanced across treatment groups. In this way, we can be confident that the only differences between participants across groups is the treatment itself. As a result, randomized trials are essentially the only type of study that permit establishing a causal relationship between a factor and an outcome. An example of a randomized study might be a black-box study, where the “treatments” consist of different levels of quality of latent fingerprints, and where participating examiners are randomly allocated a latent print for analysis.

*Randomized studies are the gold standard of experiments.*

As in the case of surveys and sampling, the size of the study is directly proportional to the precision of the estimates obtained from the data and with the power of the study to detect differences between treatment groups. In this regard, intuition is accurate, i.e. the more information we have the better we can more accurately describe what the data are showing.

#### 4.3.5 Describing Data

Once you have collected data, from either a survey, an observational study or a randomization study, the next step is to describe the data. There are two common ways



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of describing data: graphically or numerically. Each different type of data requires its own type of visualization, and of numerical descriptions. When these descriptions arise in a courtroom, it is important to make sure that the graphical or numerical summaries presented are correctly matched to the datatype.

### 4.3.6 Graphical Displays for Describing Data

The appropriate form of graphical display used for describing a collection of observations depends on the type of data (described above) and on what we are trying to summarize.

A *bar chart* is used to look at the frequencies of qualitative variables. When reading a bar chart, the length or height of the bars show which of the categories occur most often. For example, if we were interested in looking at which crimes are most often committed in the United States, we see that larceny or theft is the most frequent crime category, while rape is the least frequent.

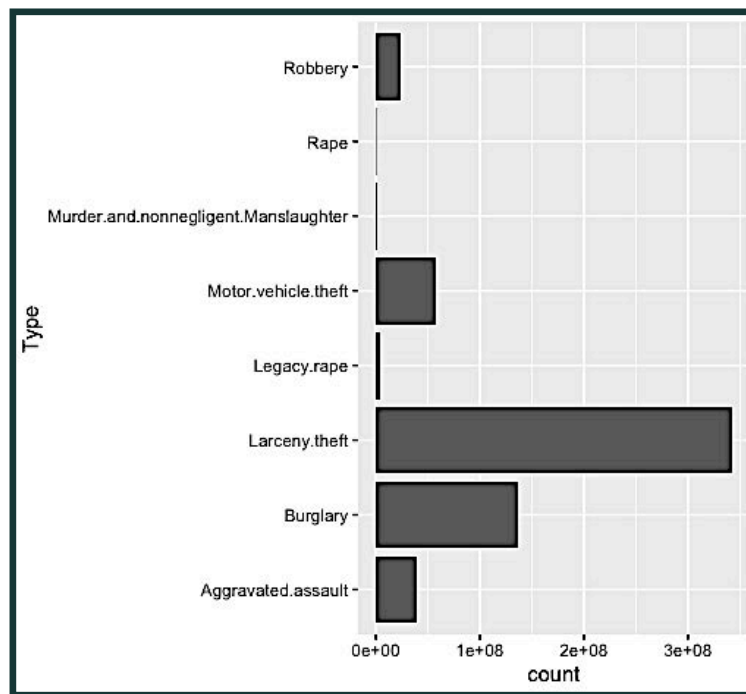


FIGURE 4.1: BAR CHART SHOWING THE TYPE OF CRIMES COMMITTED IN THE US<sup>14</sup>



When the data are quantitative, a *histogram* is used. A histogram is a graphical summary of the distribution of a quantitative variable, which can be either continuous or discrete. A histogram has an X-axis, that covers the range of the variable, and a Y-axis showing the frequency at the given range. For example, a histogram displaying the discrete numbers of CMS that were shown in Table 4.1 would appear as follows:

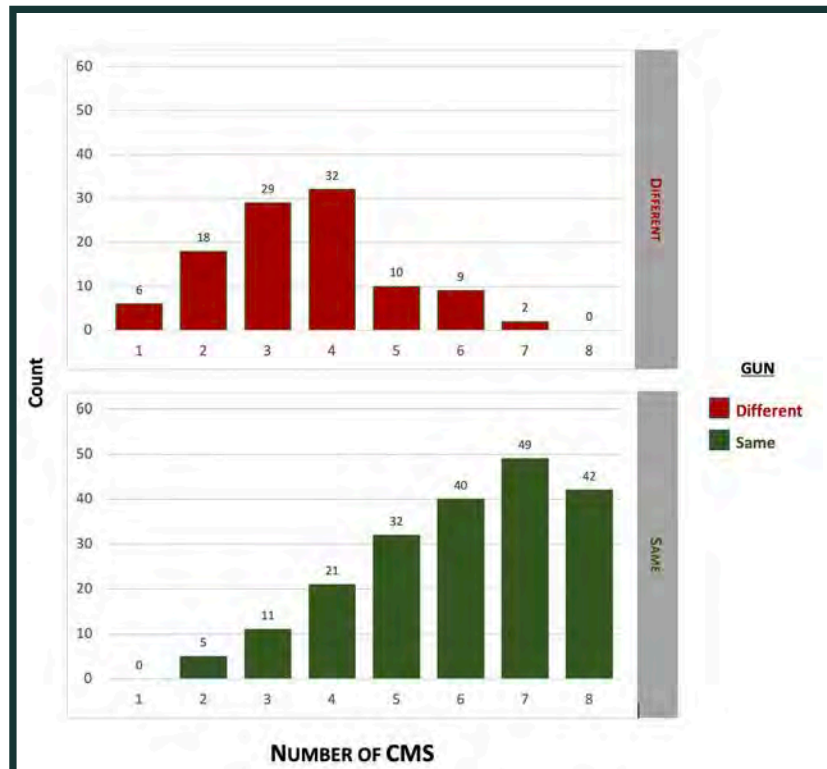


FIGURE 4.2: A STACKED HISTOGRAM OF THE CMS DISPLAYED IN TABLE 4.1

Histograms can also be used for displaying continuous measurements after we first group the measurements into bins. For example, we saw above that larceny or theft is the type of crime committed most often in the U.S, at least between 1960 and 2018. If we want to look at the distribution of larceny or theft crimes, we can draw a histogram as shown in Figure 4.3. The histogram shows the distribution of number of larceny or thefts per state and per year, as recorded by the FBI between 1960 and 2018. The highest peak of the histogram approximately corresponds to the value 10,000 to 20,000, meaning that over the 58 years reported, the most frequent number of larceny or thefts in a state was about



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27 to 54 reported per day. When histograms have “tails” of different lengths, we call the distribution skewed. The direction of the tail corresponds to the direction of the skew. In Figure 4.3, we have a right skew:

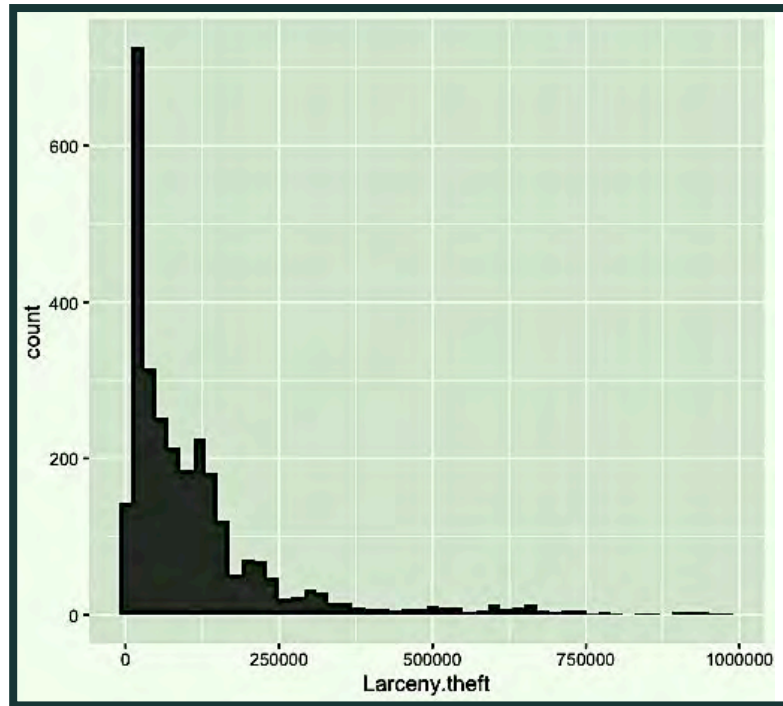


FIGURE 4.3: HISTOGRAM OF THE NUMBER OF LARCENY THEFT CRIMES COMMITTED.

When we wish to visualize the relationship between two or more different variables, we can use a *boxplot*. For example, assume we obtain glass fragments from manufacturers A and B, both located in the Midwest. Over a range of dates, we then measure the chemical concentration of some element “Y” in parts per million. In this example, the element of interest is zirconium (Zr). A boxplot is useful for displaying the range of values of Zr by day of manufacture of the fragments. In addition, we look at fragments from the different companies.

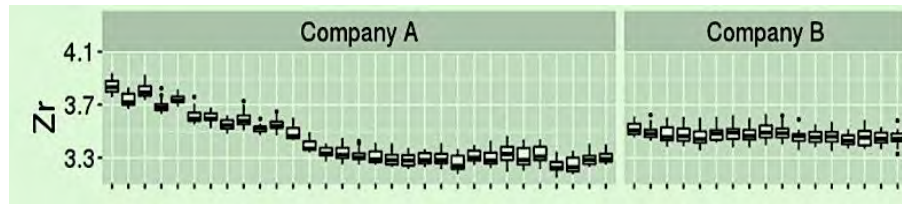


FIGURE 4.4: CONCENTRATION OF Zr IN GLASS PANES MANUFACTURED BY COMPANIES A AND B OVER 31 DAYS (A) AND 17 DAYS (B).

For each day, Zr concentrations were measured on 24 fragments obtained from each pane. Each small box summarizes measurements made on a different pane of glass.

Boxplots provide a lot of information: The *median* value of the measurements on each pane, is shown as the line in the center of the box: the box itself, which shows the middle 50% of the data. In addition, the dots denote outliers or unusual values. From Figure 4.4, we see that the concentration of Zr on glass produced by company A appears to decrease over time, where it looks approximately constant over time for company B glass. The *height* of the box is an indication of the *variability* in the Zr measurements within glass produced on the same day in each of the companies.

The final, most frequently used, figure to describe data is a scatterplot. *Scatterplots* display the relationship between two quantitative variables. The two variables can be associated in three different ways: the association can be positive, negative or none.

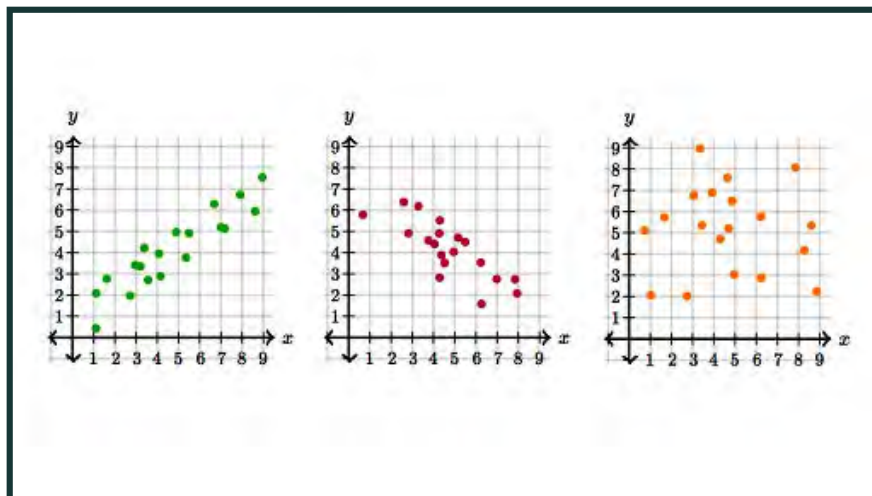


FIGURE 4.5: A POSITIVE ASSOCIATION (LEFT), NEGATIVE ASSOCIATION (MIDDLE) AND NO ASSOCIATION (RIGHT)

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In some applications, the variables shown on the x-axis (the horizontal axis) and on the y-axis (the vertical axis) are called the *explanatory* and the *response variables*, respectively. The scatterplots shown in Figure 4.5, are examples of good plots that show information in a concise and direct way. However, this is not always the case. Bad plots occur more often than statisticians would like to admit. Such plots convey inaccuracies and false information.

In sum, the goal of a graph is to be simple and easy to read, while still accurately conveying information. However, it is important to make sure the graphic displays accurately depict the relevant information.

### 4.3.7 Numeric Ways of Describing Data

Data can also be described numerically. When describing data numerically, there are two different measures used – measures of center and measures of spread.

Measures of center are measures that show where the center of a group of data points is. They include mean and median. The *mean* of a group of data points is what is commonly referred to as the “average.” Mathematically, it is the sum of the observations divided by the total number of observations:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^n y_i.$$

One characteristic of a mean is that it can be affected by *outliers*, or observations that are unusual.

The other most used measure of center is the median. The *median* is the middle number in a group of observations (If you have an even number of observations, the median is defined as the mean of the two numbers in the center).

Unlike a mean, outliers do not affect the median. For example, if we have a set of 15 measurements: 5, 16, 19, 24, 25, 25, 26, 30, 33, 33, 34, 34, 37, 37, and 40, the mean and the median are 27.8 and 30, respectively. If we add one more measurement equal to

*The mean of a group of data points is what is commonly referred to as the “average.”*

100 to the data set, the median changes, to 31.5, a difference of only 1.5 units. But the value 100 is an outlier relative to the other values, and it pulls the mean up, to 32.3, or 4.7 units. The median is a more robust measure of the center of a group of numbers in that it is less susceptible to the presence of outliers. While the mean and median are not the only measures of center, they are the most often used in statistical analysis.

Measures of spread explain how much variation is in the data. Small variation implies that the observations are all concentrated around a central point, while large variation implies that the data are spread out over a large range. The *range* is the difference between the lowest and highest values in the data set. It measures total variability of the observations. In our example above, the range is 95, i.e.,  $100 - 5$ . The range is highly affected by outliers, as it is the maximum minus the minimum values in the dataset.

*Quartiles* divide the observations into four equally sized groups, and the *interquartile range (IQR)* is defined as the middle 50 percent of the data. This measure of spread allows us to see the variability of the data without the extreme values; thus, without the impact of outliers.

When the median is used as the measure of center, IQR and range are the most often used measures of spread. When the mean is used, the measure of spread used is the standard deviation. The *standard deviation* squared is called the *variance* and is computed as the average of the squared distances between the observations and the sample mean. The positive square root of the variance is the standard deviation. The standard deviation is typically denoted SD or  $s$ . Mathematically,  $s$  is

$$s = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n - 1}}.$$

The standard deviation is always a positive value.

Because the standard deviation contains the mean in its formula, the standard deviation of a data set is highly affected by outliers. In any case, if a data set has a high standard deviation, the data are very spread out, while a low standard deviation suggests that the data are clumped together around the mean.



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When reporting statistics, it is important to report both a measure of center and a measure of spread in order to get the full picture of the set of observations. When the observations

*Unfortunately, it is common for non-scientists to report only a mean (or a median) without a measure of spread, let alone a graphical data summary.*

are very spread out, the mean is not a good summary of the data. Therefore, if only a measure of center is reported, it is not possible to determine whether the mean is an informative summary.<sup>15</sup>

In addition, including a visualization of the data set, along with a numeric summary, helps with understanding other aspects of the data. For example, assume we report the mean number of fatal crashes in Iowa per year to be 648 over the last 10 years. If we then determine that in eight of the 10 years the number of crashes was below

600, but there were two years with over 900 incidents, then we realize the mean is high because of these two high-fatality years. Thus, if just the mean is reported, there is no way to know if there are outliers in the data. However, if a graph were to accompany the numeric summary, a skew can be seen, showing more information of the whole of the data's structure. Unfortunately, it is common for non-scientists to report only a mean (or a median) without a measure of spread, let alone a graphical data summary.

### 4.3.8 The critical importance of understanding uncertainty

Every measurement is subject to some degree of uncertainty. If we measure the same object repeatedly, we will not get the exact same answer every time, because there is always some variability in the measurement process. This variability can be due to the measuring instrument, the operator and to changes in environmental conditions.

The *magnitude of the measurement variability* (or measurement error) due to instrument is often known by the scientists making the measurements. For example, chemists will typically know the limit of detection of a spectrometer or the accuracy of a thermometer. Other sources of variability may be

*If we measure the same object repeatedly, we will not get the exact same answer every time, because there is always some variability in the measurement process.*



more difficult to quantify, and some of the variability observed in a measurement may not have a known source.

In statistics, the idea of variability or uncertainty is broad, and encompasses the variation we expect to observe in some measurement due to both known and unknown sources. Uncertainty is quantified using probabilities, probability distributions, or some summary of a probability distribution, depending on the measurement of interest. Two common examples of uncertainty quantification used in every-day life are:

- Weather forecasts, e.g., the chance it will snow tomorrow is 60%.
- The proportion of Iowa voters who plan to caucus for candidate X is  $27\% \pm 3\%$ .
- The current temperature is 50 degrees F, and the measurement is accurate to  $\pm 0.5$  degree.

In the three examples above, the uncertainty quantifies variability due to different sources. In the case of the political poll, the true proportion of Iowa voters supporting X is unknowable (at least prior to the election), unless we ask every possible Iowa voter. The margin of error is inversely proportional to the number of voters we poll. It reflects the fact that if we were to poll different sets of persons, we would get a different answer each time. This is known as *sampling variability*. In the third example, the uncertainty is related to the precision of the thermometer, which in this case, is half a degree.

In the legal and forensic contexts, we are often concerned with the variability observed when the same object or related objects are measured repeatedly by the same or by different individuals. We might wish to evaluate the variability observed between:

- Repeated measurements of the same object made by the same person.
- Repeated measurements of the same object made by different persons.
- Repeated measurements of different, but similar, objects made by a single person.



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- Repeated measurements of different, but similar, objects made by different persons.

We say that measurements are *repeatable* when the same person gets similar measurements over multiple trials. We say that measurements are *reproducible* when two individuals obtain similar results when measuring the same object. Repeatability and reproducibility are both components of the concept of reliability.

*Repeatability and reproducibility are both components of the concept of reliability.*

## 4.4 STATISTICAL INFERENCE

Once data are collected, the next step is statistical inference. Statistical inference is the process of drawing conclusions about populations, or scientific truths, from data. Typically, we focus on some summary, such as the mean, of some attribute and draw inference about that *parameter* or population summary. Because we typically do not have measurements from every member of the population, inference about a parameter are almost always based on sample data. From the sample data we compute *statistics*. Intuitively, we might think that the sample mean is a good “guess” for the population mean of some attribute, and in general, our intuition would be correct. Here, we discuss the inferences about population quantities using inferential methods most likely to be introduced in the courtroom.

### 4.4.1 Point Estimation

As mentioned above, parameters are summaries of some attribute of the population, e.g., the mean, the median or the standard deviation of some variable. Because parameters pertain to the population, unless we obtain measurements from all members of that population, the true value of parameters will always be unknown. As a side note, oftentimes parameters are denoted by  $\theta$  (theta). *Point estimation* is the process of finding an *estimate*, or a good guess of a parameter—such as the mean—using measurements we obtain from a random sample of members of the population. Because we cannot know the true value of a parameter, it is almost impossible to tell whether the estimate is accurate. However, we can check whether the estimator meets the properties required by good point estimates:

- **Unbiasedness:** An estimator is unbiased when its expected value is equal to the value of the unknown population parameter it is estimating. As an example, the mean of measurements made on a representative random sample from some population, is an unbiased estimator of the population mean. A biased estimator either overestimates or underestimates the value of a population parameter. Bias can occur from a measurement error (e.g., instrument drift) or from a sampling error (e.g., when the sample does not represent the population).

- **Efficiency:** Efficient estimators have the smallest variability. Think of it this way: if we were to draw multiple random samples from the same population and from each computed an estimate for the parameter of interest, that estimating method is efficient if the variability of the estimates across the samples is small. The estimator with the smallest possible variance is also called the “best” estimator. That is, the estimator deviates from the true parameter very little. The variability of an estimate is called the *standard error* (SE) of the estimate, and it depends on the sample size. For example, the SE of the sample mean is computed as the *standard deviation* (SD) of the observations divided by the square root of the sample size.
- **Consistency:** This property states that as the sample size gets larger, the estimate gets closer to the true parameter value. As you get a larger and larger sample, we have more and more information about the population so the statistic we find from our sample will be closer to the population parameter.

Figure 4.6 illustrates some of the ideas discussed above. In this example, we wish to estimate a parameter  $\theta$  from some population. Suppose that we draw 20 different random samples from the population, each of size  $n$ , and from each obtain an estimate for  $\theta$ . The black squares in the circles in Fig. 4.6 represent the 20 sample estimates. The ideal situation is depicted in the top leftmost panel, where all sample estimates are concentrated tightly around the true parameter value shown in the center. In this case, estimators have low bias and low variance, so we can be confident that our guess for  $\theta$  is reasonable. The worst scenarios are shown on the second row, where in both panels the estimators are biased.

Other terms often used in connection with point estimates are *accuracy*, *validity*, *reliability*, *reproducibility* and *repeatability*. We provide brief definitions below.

The term *reliability* is similar to the colloquial use of *consistency*, and essentially refers to the ability to measure something well, with little variability.

*Validity* and *accuracy* refer to the closeness with which our estimator approximates the true parameter value. A biased estimator is not valid or accurate.

*Repeatability*, as the name suggests, refers to the ability of an analyst to reach the same conclusion when presented with the same problem at a later time.

*Reproducibility* on the other hand, refers to the case where two analysts reach the same conclusion when presented with the same evidence. Both reproducibility and repeatability are components of reliability.

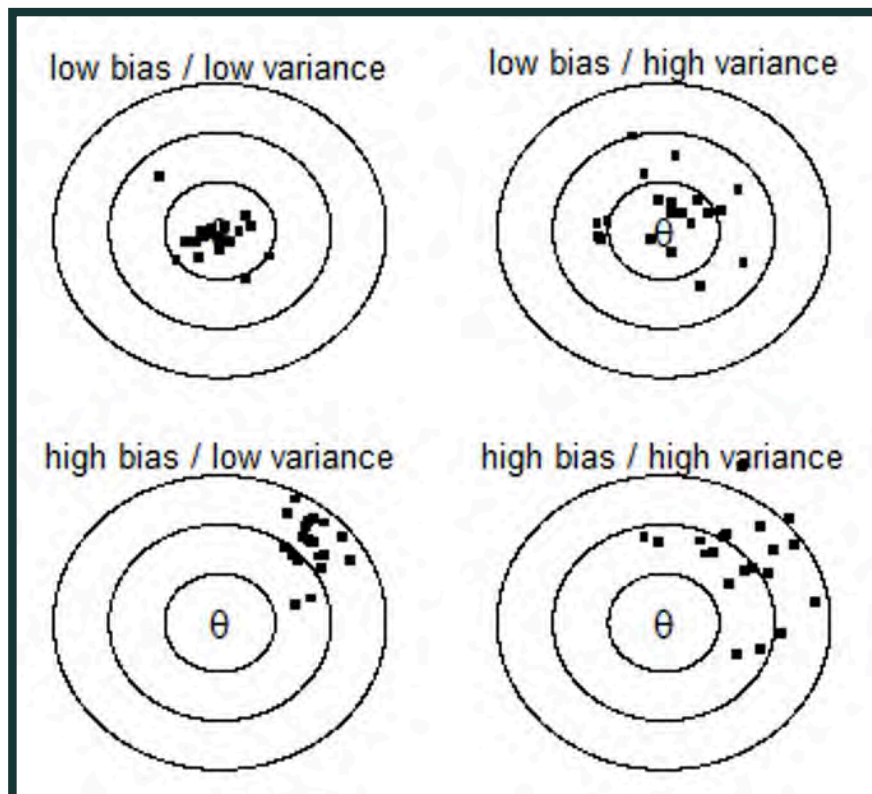


FIGURE 4.6: THE IMPACT OF BIAS AND VARIABILITY OF AN ESTIMATOR.

#### 4.4.2 Interval estimation

As we saw, point estimation results in a single value, our “best guess,” for the parameter. A limitation of this approach is that we get no information about the margin of error associated with the estimator. The *margin of error* tells us how far off we can expect our estimate to be given the sample size and the variability of the measurements with which we are working. Thus, often it is useful to report the *range* of likely values of the



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parameter. This is where intervals come in handy. An interval is constructed by adding and subtracting the margin of error to the point estimate. That is, the general form of an interval estimate is:

$$\text{Estimate} \pm \text{margin of error.}$$

The type of interval that is used sometimes depends on the type of data or on the type of data analysis being implemented. Here we focus on the most common type of interval, a *confidence interval*. When computing a confidence interval, we implicitly assume that the sample measurements are distributed more or less symmetrically around their mean. The two most commonly computed confidence intervals are for the mean of a continuous measurement or for a proportion when measurements are discrete.

A *confidence interval* is an estimated range of values that is likely to include the unknown population parameter of interest (e.g., a mean or a proportion), and is computed using the sample data. The level of confidence (C), gives the probability that the interval actually includes the true parameter value. That is, in C% of all samples taken randomly from the population, the population parameter will be contained in the confidence interval calculated using the sample data. For a single sample, we do not know if the interval includes the population parameter value, but we can be C% confident that it does. Common choices for the confidence level C are 0.90, 0.95, and 0.99. This choice of C is often dependent on the type of data and the questions we are trying answer. For example, if we were studying the effects of a lifesaving drug, that may have some negative side effects, we may want to have a higher confidence that it works. However, if we want to find a confidence interval for a drug that has no side effects, we may not need as high of a confidence level.

Confidence intervals can be either one-sided or two-sided. A *two-sided confidence interval* is centered on the sample mean or on the sample proportion, and the width of the interval is such that there is a C% chance that the interval contains (or “covers”) the true parameter value. With a *two-tailed confidence interval*, the sample estimate is directly in the center of the interval. On the other hand, a one-sided interval is not centered around the parameter value but gives more value to the lower or upper region of possible values.

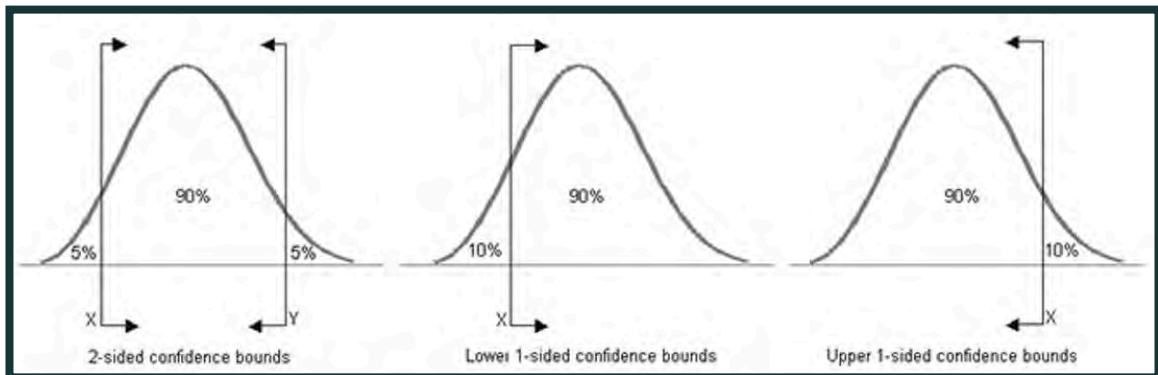


FIGURE 4.7: A VISUAL REPRESENTATION OF THE DIFFERENCE BETWEEN TWO-SIDED AND ONE-SIDED CONFIDENCE INTERVALS. NOTICE THAT BOTH USE A 90% CONFIDENCE INTERVALS; HOWEVER THE TWO-SIDED CONFIDENCE INTERVAL IS CENTERED, WHILE THE ONE-SIDED INTERVALS INCLUDE ALL POSSIBLE LOW VALUES, OR ALL POSSIBLE HIGH VALUES, DEPENDING ON DIRECTION..

The concept of a confidence interval is to provide some information about the uncertainty associated with a point estimate. The idea is to compute estimates with a small margin of error. One way to achieve this is to increase the sample size, when the realized margin of error is unacceptably large. However, the relationship between sample size and margin of error is not linear (or one to one). To cut the margin of error in half, you would need 4 times as many observations in the sample.

#### 4.4.3 Hypothesis Testing

Hypothesis testing is a standard statistical method for making inferences about an unknown population parameter. When performing a hypothesis test, we postulate two non-overlapping hypotheses, known as the null and the alternative hypothesis. The null hypothesis, denoted  $H_0$ , typically reflects our current beliefs, while the alternative hypothesis, denoted  $H_A$ , is what we wish to test. For example, assume we wanted to determine whether a coin was fair. The null hypothesis might be half the flips will result in heads. The alternative hypothesis, then, may be the number of heads and tails will be different.<sup>16</sup> The hypotheses are stated in such a way that they are mutually exclusive. That is, if one is true, the other must be false.

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Once we have formulated the hypotheses, sample data is used to compute a *test statistic* to help decide between the null or the alternative hypotheses. In the coin flip example, we might toss the coin one hundred times and count the number of heads. Suppose that we get 46 heads and 54 tails. In this case, the test statistic is the sample proportion of heads, or 0.46. The question now is whether 0.46 is close enough to 0.5 to allow us to say the coin is fair or is different enough from 0.5 to lead us to conclude the alternative. Statisticians compute a quantity called the p-value, that can help decide whether to

*The p-value, while used widely, is often mis-understood and mis-used, and with reason.*

conclude  $H_0$  or  $H_A$  given the test statistic we obtained from the sample. A very small p-value (say 0.05 or lower) leads to rejection of the null hypothesis.

The p-value, while used widely, is often mis-understood and mis-used. Formally, the p-value is the probability of observing a value of the statistic that is “more extreme” than the observed value *if the null hypothesis is true*. In our coin example, assume we obtain a p-value equal to 0.24. This says that the chance of getting 46 or fewer heads even if the coin is fair, is 24%. With this p-value, we would conclude that there is no evidence to say the coin is unfair and would fail to reject the null hypothesis. The rule is: reject the null hypothesis when the p-value is small; fail to reject when it is large.

To decide whether the p-value is small enough to reject the null hypothesis, we must choose a cutoff, or a *level of significance*. This choice is arbitrary, and typically is highly dependent on the context of the problem. When incorrectly concluding  $H_A$  is “costly” in some sense, we cautiously set a high level of confidence, and we only reject the null hypothesis when the evidence in favor of the alternative is overwhelming. Common confidence levels include 0.99, 0.95 and 0.90, which lead to cutoffs for the p-values of 0.01, 0.05, and 0.10, respectively. Consider, for example, testing whether a new drug will cure cancer. The null hypothesis is that the drug is no better than what is already on the market, while the alternative is that the drug is more effective than the best treatment available today. If the drug has no bad side effects, then we might not be too worried about incorrectly concluding the alternative and might choose a low confidence level, and a higher cut-off for the p-value of, say, 0.1. This makes it easier to reject the null hypothesis. If, however, the drug has a terrible side effect (for example, it increases the probability of a stroke), then we might want to be more cautious and only reject the

null hypothesis if we have overwhelming evidence the drug is effective for cancer. In this case, we would select a higher confidence level, say 99%, which results in a lower threshold for the p-value, 0.01, and therefore make it more difficult to reject the null.

*The p-value is often incorrectly interpreted as representing the probability that the null hypothesis is true.*

As mentioned above, the p-value is often **incorrectly** interpreted as representing the probability that the null hypothesis is true. However, the p-value says nothing about the probability of  $H_0$  (or  $H_A$ ). This is one of the reasons why statisticians are moving away from p-values, and from these artificially selected cutoffs, encouraging instead the use of strength of evidence indicators, that may be better suited to the context.

One such indicator is what is known as “effect size”; in the cancer drug example, how much improvement does the new drug effect? By focusing on the size of the effect, we emphasize the importance of practical, rather than statistical significance.

#### 4.4.4 Errors in Testing

Errors may occur when we decide between one of the two hypotheses. There are two types of errors: *Type I* and *Type II* errors. A type I error, also known as a *false positive*, occurs when the null hypothesis is rejected even though it is true. In other words, this is the error that consists of accepting an alternative hypothesis when the results we observed were due to chance. We can control the probability of committing a type I error by selecting the confidence level for the test. A type II error, also known as a “false negative” is the error we make when we fail to reject a null hypothesis when the alternative hypothesis is true. The type II error is associated with what is known as the *power of the test*. A powerful test has a low probability of a type II error, meaning that when the alternative is true, we will likely conclude that it is. There is a trade-off between the two types of error, and we cannot minimize them both at the same time; typically, we focus on setting the type I error to an acceptably low value and make sure that the sample size is large enough to ensure acceptable power.



### 4.4.5 Hypothesis Testing in the Courts

Hypothesis testing is often introduced in legal proceedings in the context of the forensic evaluation of evidence. A question asked in trials is whether the suspect is the source of some evidence found at the crime scene. For example, suppose that glass fragments are recovered from the suspect's clothing and some attribute of the glass – such as its refractive index or RI – is measured. Here, the question of interest is whether the RI of the suspect's fragments are similar enough to the RI of the broken window at the crime scene to suggest that the fragment may have originated from the scene.

The null hypothesis in this particular example is that the  $RI_{\text{window}} = RI_{\text{fragment}}$ , and the alternative hypothesis is that the RIs are different. Given measurements of the RI from both sources of glass, a statistician can compute a p-value as described earlier. If the p-value is small enough, the analyst would conclude that the RIs are not similar and therefore, that the fragment found on the suspect is not part of the broken window at the crime scene. If the p-value is not small enough, then the analyst would fail to reject the hypothesis of equal RIs and would be unable to exclude the broken window as the source of the fragment.

While in principle hypothesis testing appears to be well suited to address questions of source, there are two important caveats that we mention even though a thorough treatment is beyond the scope of this chapter:

- The weight of the evidence against the null hypothesis must be overwhelming before we are willing to reject it in favor of the alternative. In the glass example, we begin by assuming that the defendant was at the crime scene unless we can show otherwise. This seems to be backwards in the sense that in the law, a defendant is innocent until proven guilty.
- Failing to reject  $H_0$  does not imply that the fragment was once part of the window. In fact, the RIs of the two glass samples may be indistinguishable, yet the fragment could have come from some other source with the same RI. Thus, testing the hypothesis of equal measurements is the first step. The next step is to demonstrate that if the fragment had come from some other



source, it could not have had an RI that matched that of the broken window at the crime scene. In other words, the analyst should be expected to show that a coincidental match is unlikely before we can conclude they come from the same source. The statistics that have been proposed for this type of analysis include the likelihood ratio (LR) and the coincidental match probability.

#### 4.4.6 Linear Regression

So far, we have talked about inference for a single variable. *Correlation* is an indicator of the relationship between two variables. The correlation coefficient measures the strength of linear association between two quantitative variables. It ranges between -1 and 1. Negative correlations imply a negative association, while positive correlations imply a positive association between the two variables. When two variables are positively correlated, they either increase or decrease together. When two variables are negatively correlated, when one increases the other decreases. The closer a correlation coefficient is to 1 or -1, the stronger the relationship between the two variables. The figure below shows the range of the strength of correlations. Commonly, the range between 1 and .7 is considered a strong relationship, .7 to .3 a moderate relationship, .3 to 0 a weak relationship and 0, no relationship. However, these strengths of relationships often depend on the type of data with which we are working.

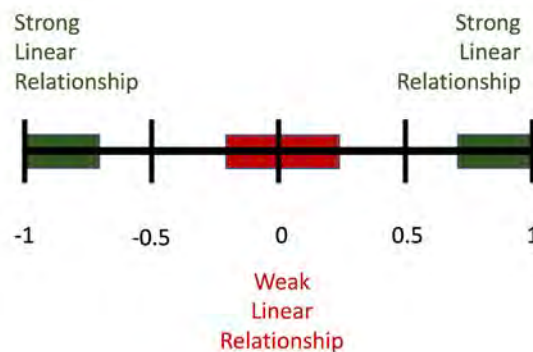


FIGURE 4.8: STRENGTH OF RELATIONSHIPS BASED ON CORRELATION COEFFICIENTS

Correlation does not mean causation. Just because two variables are highly correlated, does not mean one variable causes the other. For example, there is a high positive

## 4. INTRODUCTION TO STATISTICAL THINKING FOR JUDGES

correlation between number of TV sets per person and average life expectancy. That does not mean one should buy several TV sets to have a long life. Instead, it is more likely that

*Correlation does not mean causation. Just because two variables are highly correlated, does not mean one variable causes the other.*

some other variable, or variables, such as wealth, may be creating an association between TVs and life expectancy. These *lurking variables* can have important effects on the associations we observe. A common problem, however, is these lurking variables are often not included as part of the data collection.

While the correlation coefficient is a useful measure of the association between two variables, sometimes we wish to go further and *model* that association.

The simplest statistical model is a straight line, to provide a good representation of the relationship between the variables. Such a line is called a *linear regression line*.<sup>17</sup> A regression line explains how the values of the *response variable* change in relation to changes in the value of the *explanatory variable*. For a response variable  $y$ , and an explanatory variable  $x$ , the linear regression line is defined by:

$$\hat{y} = b_0 + b_1x,$$

where  $b_0$  is the intercept and  $b_1$  is the slope of the line. That is, for a one unit increase in the explanatory variable ( $x$ ), the predicted value of the response variable ( $y$ ) will change by an amount equal to the slope. This gives us a reasonable way to quantify the relationship between the two variables. When the slope is negative, there is a negative correlation; when the slope is positive, there is a positive correlation.

In most cases, the slope is the parameter we most care about. For example, suppose a town wants to build a new fire station. In order to find a good location, they examine the relationship between the distance from the fire station and the amount of damage to homes from past fires (in thousands of dollars). Figure 4.9 shows the scatter plot with the regression line.

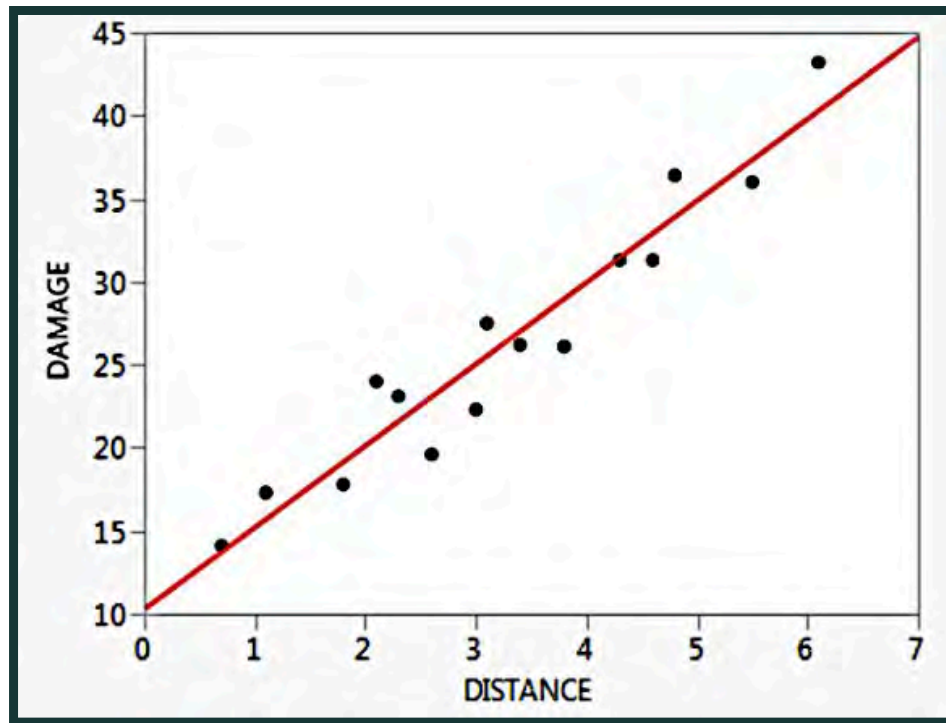


FIGURE 4.9: THE REGRESSION LINE DEPICTING THE RELATIONSHIP BETWEEN DISTANCE FROM A FIRE STATION AND DAMAGE IN THOUSANDS OF DOLLARS.

In this example we find that  $\text{Damage} = 10.28 + 4.92 \times \text{Distance}$ . Interpreting this, we would say that, for every extra mile away a property is from the fire station, we expect the damage to increase by 4.92 thousand dollars.

*Extrapolation, or predicting a response value for an x-value outside the scope of the data, is risky.*

When appropriate, we can use a regression line to predict the expected value of a response variable given the value of the explanatory variable. In our example, we would expect a property five miles from the fire station to sustain damage of approximately \$34.88 thousand. However, these predictions can be very inaccurate when we extrapolate beyond the range of the data we used to estimate the regression line.

*Extrapolation, or predicting a response value for an x-value outside the scope of the data, is risky.* We really do not know whether the association between y and x continues to be linear beyond the range of our data. Figure 4.10 shows what might happen when

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we extrapolate. The blue dots represent the sample data, the blue line is the regression line estimated from those data, and the red curve represents the true (but unknown) relationship between  $x$  and  $y$ . If we only observe the response  $y$  for values of  $x$  between 0 and  $\tilde{x}$ , then we would believe that their relationship is linear. But if we wish to use the estimated regression line to predict the response for a value of  $x$  equal to  $x^*$ , we will make a huge error because beyond  $\tilde{x}$ , the relationship between  $y$  and  $x$  is no longer linear.

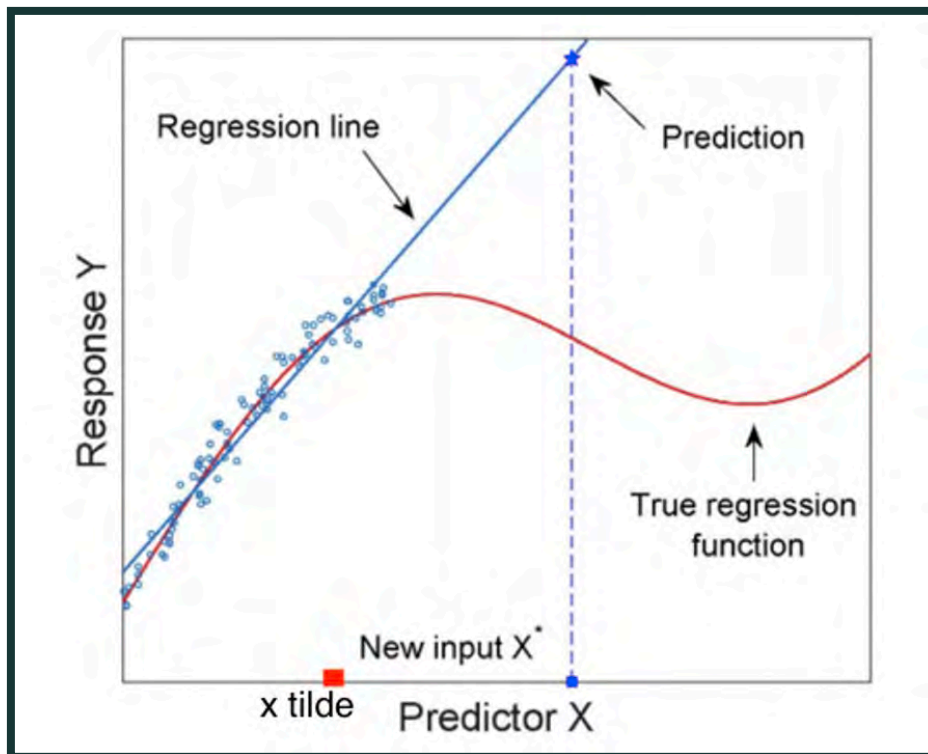


FIGURE 4.10: A VISUAL REPRESENTATION OF THE RISK THAT PREDICTING OUTSIDE THE SCOPE OF THE DATA MAY LEAD TO.

For example, consider plotting the height of a sample of persons against their age, but only conducting the study with participants no older than 10 years of age. While this study may predict accurately the height of pre-adolescents, it would not reliably predict the height of a 49-year-old.



Another caution regarding the use of linear regression is that the relationship between the response  $y$  and the explanatory variable  $x$  needs to be linear. If the relationship between the two variables is not linear, you should not summarize it with a line. For example, income tends to rise almost linearly as years of education increase between 0 and about 16, but the relationship flattens after that point. Thus, whether you went to school for 18 or for 24 years, your income will tend to be unaffected.

Another problem that may arise when using linear regression is known as overfitting. *Overfitting* occurs when a function is too closely fit to a limited set of data points. In the case of linear regression, overfitting can occur when the sample size is small or when the range of the explanatory variable is limited. The consequence of overfitting is a decrease in the accuracy with which we can predict the response for a new value of the explanatory variable.

Statisticians have developed many diagnostic tools that a user of linear regression can implement to decide whether the linear regression model is “good.” By “good” we mean the model fits the sample data reasonably well and has good predictive properties, and that the sample data do not violate any of the assumptions implicit in the method. Perhaps the most common approach to carry out a diagnostic for the linear regression model is a *residual analysis*.

For more information about regression modeling, residual analyses and other tools, the reader should refer to any introductory statistics book. Two good references are: *An Introduction to Statistical Learning*<sup>18</sup> by James Gareth, et al., and *Intro Stats* by Richard De Veaux.<sup>19</sup>



### 4.5 SUMMARY

Statistics, like other fields of study, provides a number of tools that may be of assistance in understanding and interpreting data of many different types. We have sought herein to explain some of the common concepts encountered in statistical analysis with the hope it will aid in evaluating statistical evidence.

## 4.6 DEFINITIONS FROM SECTION 4 (IN ALPHABETICAL ORDER)

**BAYES THEOREM:** a theorem that computes the probability of an event based on prior knowledge about the event and on the probability of conditions that may be related to the event.

**BIAS:** a systematic distortion of a statistical result due to a factor not accounted for in its computation.

**COEFFICIENT OF DETERMINATION:**  $R^2$ , the proportion of the variance in the response variable that can be explained by the explanatory variable(s).

**CONDITIONAL PROBABILITY:** a measure of the probability of an event occurring given that another event has occurred.

**CONFIDENCE INTERVAL:** a range of values around an estimate of a quantity, that reflects uncertainty about the true value of the quantity. In statistics, the quantity we wish to estimate is often called a parameter.

**CONFIDENCE LEVEL:** the probability that the confidence interval covers the true value of a parameter.

**CONTINUOUS VARIABLE:** A variable that can take on any value within an interval.

**CORRELATION:** a quantity measuring the extent of the interdependence of two or more variables.

**DATA:** facts and statistics collected together for reference or analysis.

**DISCRETE:** A variable that can only take on integer values, i.e., whole numbers, within an interval.

**EXPERIMENT:** a scientific study undertaken to make a discovery, test a hypothesis, or demonstrate a known fact.

**EXPLANATORY VARIABLE:** The x variable; a variable that explains or predicts changes in another variable, known as the Response Variable.

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**HYPOTHESIS:** a supposition or proposed explanation based on limited evidence as a starting point for further investigation. The statement at the beginning of a hypothesis test explains what is being tested.

**INDEPENDENCE:** the attribute of a variable whose variation does not depend on the variation of another.

**INTERQUARTILE RANGE:** the range of the middle 50% of a data set.

**JOINT PROBABILITY:** the chance of two events occurring together.

**LINEAR REGRESSION:** approach to modeling the relationship between a response (or dependent or response variable) and one or more **Explanatory Variables** (or independent variables) by a straight line.

**LONG RUN FREQUENCY:** establishes the probability of an event by the frequency with which the event occurs in a very large number of trials.

**LURKING VARIABLES:** a variable unknown and not controlled for but which has an important, significant effect on the variables of interest.

**MEAN:** the mathematical average of a collection of observed values.

**MEDIAN:** the midpoint of a frequency distribution of observed values. Half of the data values are below the median and half are above.

**OBSERVATIONAL STUDIES:** A study in which the study subjects are not randomly assigned to treatments by the investigator.

**ODDS:** ratios of probabilities, describing how likely an event is to occur.

**ORDINAL DATA:** statistical data type where the variables have natural, ordered categories and the distances between the categories is not known.

**OUTLIERS:** a data point on a graph or in a set of results, that does not follow the general pattern of the data.

**OVERFITTING:** when a function is too closely fit to a limited set of data points.

**PARAMETER:** a numerical or categorical measurement that describes the population.

**POPULATION:** the universe of objects of interest.

**POINT ESTIMATE:** a single value computed from a sample, used as an “educated guess” of the value of a parameter for a population.

**PROBABILITY:** The probability of an event is a number between 0 and 1 that reflects the likelihood that the event occurs.

**PRODUCT RULE:** if events A and B are independent, then their joint probability is the product of the probability of A and the probability of B.

**QUALITATIVE DATA:** data that are not numerical but fit into categories. An example is marriage status.

**QUANTITATIVE DATA:** data that are numeric. An example is annual income.

**RESPONSE VARIABLE:** a variable (often denoted by y) whose value depends on that of another.

**SAMPLE:** a set of objects that are available for study and that were obtained from the population of interest.

**SAMPLING:** the action or process of drawing samples from a population, typically for statistical analysis.

**STANDARD DEVIATION:** a measure of how much variation there is in a set of data.

**STATISTIC:** a numerical measurement that describes an attribute of the sample.

**TYPE I ERROR:** in a test of hypothesis, rejecting the null hypothesis, when in fact the null is true.



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**TYPE II ERROR:** Failing to reject the null hypothesis, when in fact the null hypothesis is not true.

**VARIANCE:** a measure of how much variation is in a set of data, computed as the standard deviation squared.



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### 4.8 ENDNOTES

1. Eryn Blagg is a doctoral student in the Department of Statistics at Iowa State University
2. Alicia Carriquiry is distinguished professor of Statistics at Iowa State University, and Director of the Center for Statistics and Applications in Forensic Evidence (CSAFE)
3. Blagg's and Carriquiry's work was partially funded by the Center for Statistics and Applications in Forensic Evidence (CSAFE) through Cooperative Agreement 70NANB20H019 between NIST and Iowa State University, which includes activities carried out at Carnegie Mellon University, Duke University, University of California Irvine, University of Virginia, West Virginia University, University of Pennsylvania, Swarthmore College and University of Nebraska, Lincoln.
4. Butler, J.M. 2014. *Advanced Topics in Forensic DNA Typing: Interpretation*. First Ed., Academic Press. 608 pp.
5. Mathematically the odds of an event occurring is as follows:  

$$\text{Odds}_f = \frac{\text{Probability that } Y \text{ occurs}}{\text{Probability that } Y \text{ does not occur}}$$
6. Probability in mathematical terms:  

$$\text{Pr}(\text{died 18- 20 hours ago}) = 0.9$$
7. We write:  $\text{Pr}(A|B)$  to denote the probability of observing event A given that event B has occurred. In the example:  $\text{Pr}(\text{died 18-20 hours ago} \mid \text{body was in the cold}) \leq 0.2$
8. This is a frequency table. The goal of a frequency table is to visually display the different counts of each of the categories.
9.  $\text{Pr}(A \text{ and } B) = P(A) \times P(B)$ .
10. Butler, J.M. 2014. *Advanced Topics in forensic DNA Typing: Interpretation*. First Ed. Academic Press, 608 pp.
11.  $\text{Pr}(A \mid B) \neq P(B \mid A)$ .

12. Mathematical formula of Bayes Theorem:

$$Pr(A|B) = \frac{Pr(B|A) \times P(A)}{Pr(B)}$$

13. <https://www.chicagotribune.com/nation-world/chi-chicagoday-deweydefeats-story-story.html>
14. The FBI Data has come from the Uniform Crime Reporting from the US Department of Justice found at <https://www.ucrdatatool.gov/index.cfm>. These data were collected between 1960 and 2018.
15. A good visual introduction to these topics can be found here : <https://seeing-theory.brown.edu/index.html#firstPage>
16. Symbolically, these hypotheses would be expressed as  $H_0: P_{\text{heads}} = 0.5$  and  $H_a: P_{\text{heads}} \neq 0.5$
17. Here we reference linear regression. There is also polynomial regression. Some good resources for these topics are: <https://towardsdatascience.com/5-types-of-regression-and-their-properties-c5e1fa12d55e>
18. James, Gareth, Witten, Hastie, and Tibshirani. *An Introduction to Statistical Learning: With Applications in R.* , 2013. Print.
19. De Veaux, et al. *Intro Stats*. Pearson, 2018.



An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops. The background is dark, and the mesh is overlaid with faint, light-colored numbers, creating a complex, data-driven visual effect.

# 5. PRE-TRIAL CIVIL

Sections 5.1 - 5.6

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**HON. JOSEPH J. MALTESE**

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## 5.1 INTRODUCTION

While scientific testimony in criminal cases steal the headlines and are the subject of numerous television programs, judges in civil cases are more likely to be the gatekeeper of scientific evidence in the courtroom throughout the United States. A recent study by the Federal Judicial Center, the judicial educational organization for the federal judiciary, found that most of the trials involving expert testimony were civil:

- 45% were tort cases, primarily involving personal injury or medical malpractice;
- 23% were Civil Rights cases;
- 11% were contract cases;
- 10% were intellectual property cases, primarily patent cases;
- 2% were labor cases;
- 2% were prisoner rights cases and;
- \*% were other civil cases.<sup>1</sup>

However, as *Chart 5.1* shows only slightly more than half of the experts provided scientific or medical expert testimony.<sup>2</sup>

Civil proceedings often require expert testimony in order to prove or disprove causes of action. Airplane crashes, railroad and ship collisions, and countless negligence cases from automobile, truck and motorcycle crashes all require expert scientific evidence.

Expert testimony from the members of the National Transportation Safety Board (NTSB) and/or crash reconstructionists are often required to testify about the element of crash causation. In engineering and product defect cases ranging from bridge and building collapses to faulty equipment causing serious injury or death, all require scientific and technical expertise.





Even pedestrian slips and falls on stairways or snow and ice may require an expert on kinesiology or a meteorologist to make out a plaintiff's case. In order to prove or disprove a professional medical malpractice case, medical experts must opine that the defendant doctor, dentist or health care provider deviated from the applicable professional standard of care which proximately caused injury to the plaintiff. An expert health care provider in the same or similar specialty as the defendant is required to discuss that standard of care and give an expert opinion for the case to proceed to trial.



CHART 5.1

Toxic torts and hazardous waste materials may cause injury to humans, other animals, and crops, as well as reduce the value of buildings. They may foul the environment in the air, water and soil, which may require expert witnesses in chemistry, biology, botany and environmental science to prove or disprove the quantum and effects of such toxins.

In family courts, divorce, custody and visitation cases may require the expertise of mental health professionals like psychologists. The contested probate of a will may require medical and/or psychiatric experts to ascertain the condition of the testator when he or she signed the will, as well as questioned documents examiners to give expert opinions to the court whether the signature on the will is that of the testator. Establishing the impact of sexual harassment and sex abuse requires experts who have the education, training and experience to give opinions about rape trauma syndrome and battered child syndrome to explain why the victims acted the way they did after the event or refused to discuss it for years thereafter.

In spite of the constant use of this type of testimony in civil actions, most state jurisdiction only require that plaintiffs provide “notice” in their complaint that identifies the claims asserted against defendants.<sup>3</sup> The result is that neither judges nor the parties have a complete understanding of the scope of the scientific evidence that will be offered in a trial. This makes the discovery process of critical importance in cases involving science evidence.



## 5.2 PRE-TRIAL DISCOVERY OF AN EXPERT

Attorneys consult with experts in order to assist them in preparing a *prima facie* case for trial. They generally acquire this evaluation in order to obtain a possible recommendation to proceed or not to proceed with the case. Some attorneys may not initially want a written report from an expert because all written reports are discoverable. However, once a report is reduced to writing, counsel must comply with either the Federal Rules of Civil Procedure (FRCP), or appropriate State Rules of Procedure, and federal and state Rules of Evidence, which generally mandate that written expert reports shall be turned over to opposing counsel.<sup>4</sup>

FRCP 26, generally governs the disclosure of expert testimony.<sup>5</sup> This rule requires disclosure of any person who may be testify at trial presenting scientific and other expert evidence.<sup>6</sup> Failing to disclose the existence of such a witness can result in a serious penalty. FRCP 37(c) states that the party who fails to disclosure “is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless.”<sup>7</sup> Several courts have interpreted this rule as requiring mandatory exclusion of such evidence. However, judges still have the discretion to decide whether the failure to disclose is harmless.<sup>8</sup>

The submission of a written disclosure report is also required when an expert was “retained or specially employed to provide expert testimony,” or the expert’s “duties as the party’s employee regularly involve giving expert testimony.”<sup>9</sup> However, when an expert who does not regularly testify as an expert expresses an opinion derived from firsthand knowledge, a report may not be required.<sup>10</sup> As one court explained: “[I]f a physician’s opinion regarding causation or any other matter was formed and based on observations made during the course of treatment, then no Subsection B (FRCP 26 (2)(B))<sup>11</sup> report is required, albeit the Subsection C (FRCP 26 (2)(C))<sup>12</sup> report discussed above will be required. If, however, the physician’s opinion was based on facts gathered outside the course of treatment, or if the physician’s testimony will involve the use of hypotheticals, then a full subsection B report will be required.”<sup>13</sup>

### 5.2.1 An Expert's Report

The report itself should contain:

- a. a complete statement of all opinions, which may be expressed at trial;
- b. the basis and reasons for the expert's opinion;
- c. data and information on which the opinion is based;
- d. exhibits to be used to support the opinion;
- e. a curriculum vitae or resume;
- f. all publications within the past 10 years;
- g. compensation to be paid for the study and testimony; and
- h. a listing of previous cases in which the expert had testified (either at trial or deposition) within the preceding four years.<sup>14</sup>

A judge can either set a date for the disclosure of the expert witness in a scheduling order or rely on the date set in the rules of civil procedure.

A discovery deposition of an expert witness in the absence of an agreement otherwise is admissible at trial.<sup>15</sup>

### 5.2.2 Ghost Writers

An expert witness report or an appended journal article, or study presented as that of the testifying expert should be that of the expert and not the affidavit or work product of a colleague or the attorney presenting the case. In civil matters attorneys knowing what is needed to be stated to the court in order to make out a prima facie case or to survive or defeat a summary judgment motion frequently craft affidavits for their clients, but on occasion, also write out the expert witness affidavit with the necessary words to support their case. While it is not objectionable to advise experts that they need to follow a certain format for an affidavit or certification, it is fraudulent and unethical to supply the substantive contents of the expert's report.

The opinion must be solely that of the expert. Frequently, such reports are offered with or without the author of the report or the scientist or technician who conducted the test. While the confrontation clause of the U.S. Constitution that exists in a criminal case does not apply in a civil action, foundational problems regarding admissibility still do.



### 5.3 JUDGE'S ROLE AS A GATEKEEPER IN PRE-TRIAL PROCEEDINGS

In most jurisdictions, once the plaintiff serves a summons and complaint and the defendant has served an answer or files a pre-answer motion to dismiss the complaint, then the judge typically will have the counsel or pro se litigants appear for a preliminary case management conference.

At the initial preliminary case management conference, the judge should take charge to manage the litigation by having counsel for the parties collaborate electronically, or meet in person before the conference, to hopefully agree to the terms for the preliminary case management order to establish what issues exist and how to resolve them short of trial by discovery. This is particularly important in cases involving potential scientific evidence.

The judge, as the manager of the litigation docket, should attempt to limit trial issues generally and scientific disputes specifically if possible, by written stipulations without the necessity of formal written motions. The judge should also ascertain what discovery is necessary and how the parties generally intend to meet their burdens of proof.

*The judge, as the manager of the litigation docket, should attempt to limit trial issues generally and scientific disputes specifically.*

The judge should ascertain what are the key issues in the case and who potentially is going to testify at a trial. The parties and non-expert witnesses who testify will outline the case by direct examination to the “who, what, where, when, how and possibly why” the cause of action arose. The opponents will scrutinize these witnesses and will cross-examine them generally utilizing indirect conclusory questions in a “yes” or “no” manner. As discussed above, as early as possible, the parties should disclose their expert witnesses and the general substance of that testimony.

The parties need foundational specific information regarding what the expert witnesses will say and the basis for their testimony. Reasonable discovery of these expert witnesses in the form of written interrogatories in lieu of or followed up with oral or video depositions under oath should be encouraged.

Since depositions are costly, time consuming and sometimes difficult to schedule and complete, the judge should ascertain what depositions are really necessary and limit the number of depositions, without prejudicing any of the parties. The scheduling order should establish rules for the conduct of fair and efficient depositions. The judge should prohibit speaking objections and require that objections be stated concisely and in a non-argumentative manner. If the attorneys or parties cannot comport with these rules, the court may order that all future depositions be videotaped for judicial review or require counsel to expeditiously deliver a copy of the transcript to the court for review. In the case complex scientific evidence, the court may also order that a special master or magistrate be present at the deposition to make immediate rulings and that the parties pay for such person to be available.

The parties should be encouraged to advise the court as soon as possible if they are seeking a protective order from discovery upon a claim of privilege or that certain matters are attorney work product or trade secrets. Such materials should be reviewed *in camera*. Such matters should be ruled upon as soon as possible and may require the assistance of a Special Master. The court should only protect those matters for which a clear and significant need for confidentiality has been demonstrated.

The initial case management order should include a detailed schedule of which party will do what by a particular date. The order should provide the date when information such as a bill of particulars, documents, photographs and tapes in support of the scientific evidence, will be disclosed. The order should also include the persons to whom interrogatories are to be served and the dates when responses are required. If appropriate, it should list when the plaintiff is to be physically and/or mentally examined by particular health care professionals on behalf of the defendants. The order should also list the parties, fact witnesses and expert witnesses with their specialty who are requested to be deposed under oath on or

before specific dates. Lastly, the Initial Case Management Order should include a date discovery is to be completed and a date short of the completion date for a Compliance Conference to enable the judge to monitor the progress of the discovery. Judges should direct that no discovery or compliance motions shall be made until the parties have documented that they have attempted to resolve the discovery dispute and may then advise the court, who should immediately intercede to resolve the dispute short of costly and time-consuming motion practice.

At the Compliance Conference the judge should issue an Amended Case Management Order covering all discovery matters not otherwise completed with dates certain for completion and a provision that if there is not compliance by the dates ordered, the court will consider sanctions, including monetary fines against the non-compliant attorneys and/or their clients, striking in whole or in part the plaintiff's complaint and/or the defendant's answer, counterclaims and cross-claims. The court may also consider precluding certain documents, witnesses or parts of their proffered testimony. The court should then re-establish a final compliance date when discovery is to be completed.

If the case does not settle prior then the amended order should require the parties to serve and file their motions for summary judgment, to include any motions for a *Frye* or *Daubert* hearing to preclude particular expert witnesses and/or their expert opinions in whole or in part, as well as their exhibits including reports, studies and professional texts or journal articles.

Scrutinizing expert witness reports and the appended professional journal articles and studies supporting the expert opinion is no easy task for judges. The reports on highly technical or scientific matters, with the underlying journal articles and studies, should be presented to the court when attorneys seek the judge's consideration and adoption of those studies and journal articles as the basis of support of an expert.

In the case of *General Electric Co. v. Joiner*,<sup>16</sup> the Supreme Court held that a trial court's decision excluding testimony from the plaintiff's experts and granting the defendants' motion for summary judgment, established that a judge could apply *Daubert*<sup>17</sup> criteria in a pre-trial hearing. Applying the abuse of discretion standard,



the justices reviewed the trial court record and found that the court had properly excluded the plaintiff's experts in a pre-trial hearing. Chief Justice Rehnquist writing the majority opinion said that it was within the district court's discretion to conclude that the plaintiff's experts: "conclusions and methodology are not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in either *Daubert* or the Federal Rules of Evidence (FRE) requires a district court to admit opinion evidence which is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered."<sup>18</sup> Thus, *Joiner* allows judges to conduct FRE 104(a)<sup>19</sup> hearings prior to trial.

States following the *Frye* criteria follow a similar practice.<sup>20</sup> The procedure generally starts with a motion in limine to exclude the evidence. Once the motion is filed, a judge can conduct a hearing to determine whether the scientific evidence that is the subject of the motion is admissible. In the hearing the burden of proof rests with the party proffering the evidence.<sup>21</sup> That evidence can include scientific publications, practical applications, the testimony of scientific experts and earlier court decision allows such evidence.<sup>22</sup>

At a pre-trial hearing on the admissibility of scientific evidence the expert witness report ought to be presented and reviewed. The judge must review all the materials submitted and render a decision whether the expert witness or evidence will be admitted into evidence prior to the empaneling of a jury.

The following are some considerations a judge may consider when scrutinizing scientific studies or reports:

- Who wrote it?
- Who did the actual research? Research assistants, laboratory technicians
- Who funded the study? Government, university, private foundation, pharmaceutical company, plaintiffs' or defendants' attorneys

- What is the size of the sample groups? Is it representative of the universe being studied? What is the selection bias? What is the sampling bias?<sup>23</sup> What controls were used?
- What are the methods and procedures used?
- Did the study utilize accepted methods and procedures and did the researcher follow those methods and procedures?
- Over what period of time was the study conducted? Are the dates significant?
- What was the margin of error of the study? How was it calculated?
- Was the data statistically significant?
- Who analyzed the data? Was it the researcher who initially established a hypothesis or was it an independent source?
- What conclusions were reached?
- Were the conclusions and the data fully published and subjected to peer review?
- Do other studies confirm or refute the conclusions of the study being asked to be accepted as proof of a theory to be testified to by an expert witness before the court?

Encouraging or allowing pre-trial hearing on the admissibility of scientific evidence has several advantages. Judges can take the time to educate themselves about complex scientific evidence without the pressure of a jury trial. In jurisdictions following *Daubert*, evidence that would not be admissible at trial can be admitted and considered for purposes of the hearing.<sup>24</sup> Finally, a pre-trial ruling on the admissibility of scientific evidence may obviate the need to conduct a trial either by creating an atmosphere for a settlement or encouraging a motion for summary disposition.





## 5.4 JUDICIAL RESEARCH ON NON-LEGAL MATTERS, SCIENTIFIC OR TECHNICAL

While most judges have limited exposure to scientific or technical methods and procedures when presented with such cases, it is only natural for a judge to seek knowledge about such topics, which he or she will be called upon to admit or not admit into evidence. The obvious quick fix to attain such knowledge is to turn to the search engines on the computer, which may produce scientific and technical information from various sources. This search for knowledge may present some ethical issues for the judge as the internet becomes an ex parte hearsay source of information, which is not scrutinized or cross-examined by the parties to the lawsuit. In some high-powered mass tort litigation, the judge may require that a court appointed expert conduct a formal tutorial for the judge, in the presence of counsel. This may not be practical or affordable in most instances as it is generally the counsel for the parties who will pay for this neutral court appointed expert. The parties may object as they are compelled to pay for their own experts, who will generally support their posture in the case.

*Googling scientific or technical information may present ethical issues for the judge.*

Merely telling judges not to research the scientific or technical topics so as not to appear ignorant or non-conversant with the technical jargon may prove to be an effort in futility. An appropriate remedy may be to have the parties present materials that give an overview of the general topic and permit them to comment about the materials presented by their adversary. Judges who nonetheless conduct their own non-legal research should disclose copies of what they found to all parties and have them comment about such materials in order to be open and allow for criticism. This has been the subject of debate in the legal community.<sup>25</sup> Judges should be aware of the particular rulings and the policy on independent non-legal research in their jurisdiction.

When presented with scientific, technical or other specialized evidence, judges and lawyers should review the evidence under their state standard of admissibility of either the *Frye* or *Frye Plus* (reliability) test or the *Daubert* standards. (See Chart 5.2.)

# THE DUAL APPROACH IN EVALUATING SCIENTIFIC OR TECHNICAL EVIDENCE

A. **Frye Plus Test** = general acceptance plus reliability of procedure or methodology forming the theory or opinion.

1. Is the underlying theory or procedure of the expert opinion new or novel?

**NO**

No need for a hearing.

**YES**

Continue.

2. Is the underlying theory, procedure or methodology generally accepted in the relevant specialized community? (*Frye* test)

**NO**

No need for a hearing.

**YES**

Continue.

3. Are the procedures implementing the theory, procedure or methodology generally accepted?

**NO**

No need for a hearing.

**YES**

Continue.

4. Were the procedures followed accurately to yield sufficiently reliable results to be admissible to a trier of fact?

**NO**

No need for a hearing.

**YES**

Continue.

**If the elements are present, then the evidence should be admissible.**

# THE DUAL APPROACH IN EVALUATING SCIENTIFIC OR TECHNICAL EVIDENCE

## B. *Daubert/Kumho* reliability factors:

Is the methodology valid as to:

Testing

Acceptable error rate

Peer review of results

Any other relevant and reliable factors

NO

If not reliable then exclude.

YES

If reliable then admit.

C. **Final Note:** Remember, the *Daubert* “scientific reliability” standards were intended to expand the restrictive *Frye* “general acceptance” test – not further restrict it.

CHART 5.2

## 5.5 CONCLUSION

When comparing the *Frye* Plus<sup>26</sup> (reliability) test (New York) or the *Kelly/Frye* test<sup>27</sup>(California) or *Robinson* tests<sup>28</sup> (Texas) or any other tests with the *Daubert/Kumho* standards, one may observe that the differences may be more semantical than scientific. All standards attempt to admit reliable evidence and exclude unreliable evidence. The review may differ slightly on the approach to new theories or methods. Since the *Daubert* decision, the courts have given greater scrutiny to experts and their opinions.

*Daubert* created a new skepticism in reviewing forensic comparison evidence such as handwriting, bite marks, tool marks and even fingerprinting.<sup>29</sup> After the forensic experts learn how to satisfy the challenges by presenting a clear demonstration of their experience based upon expertise through scientific evidence hearings, the courts will in turn become acquainted with the skills, training and experience of the experts and their body of technical and specialized knowledge that, for the most part, will meet the *Daubert/Kumho* standards.

Notwithstanding the post-*Daubert/Kumho* attacks on the validity of forensic evidence, most forensic sciences that were heretofore found to be “generally accepted,” will continue to be “generally accepted” by the courts after the expert communities undergo some re-evaluation and validity testing of the techniques and methodology employed by the experts. Forensic experts should also undergo meaningful periodic certification to attest that they are qualified to conduct such forensic tasks.

Until new theories or some old theories have been validated to explain the procedures and methodology in reaching their conclusions, the validity of those theories will be challenged until such time as they achieve general acceptance within their discipline and the courts. In order for a theory or procedure to achieve “general acceptance,” it usually undergoes some or all of the factors outlined in *Daubert* and *Kumho*.



After the court decides the motions for summary judgment and *Frye* or *Daubert* motions, if the plaintiff's causes of action are not dismissed or their expert witnesses precluded from testifying in whole or in part, then the court should revisit settlement before finally scheduling a trial date.



## 5.6 ENDNOTES

1. U.S. District Court Judicial Caseload Profile Report (Aug. 8, 2005) (on file with author).
2. *Id.*
3. Spencer A. Benjamin, *Pleading in State Courts after Twombly and Iqbal*, U. OF VIRGINIA SCH. OF L. (2010) [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2038349](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2038349)
4. As each State has adopted its own rules of civil procedure and most are based to some extent on the Federal Rules of Civil Procedure, the citations in this section will rely on the Federal Rules.
5. FED. R. CIV. P. 26 - General Provisions Governing Discovery

### **Required Disclosures - Methods to discover:**

#### **... (2) Disclosure of Expert Testimony**

A party must disclose the identity of any person (expert witnesses) who may be used at trial to present evidence under rules 702, 703, or 705 of the Federal Rules of Evidence.

Experts must submit and sign a written report containing:

- a complete statement of all opinions, which may be expressed at trial;
- the basis and reasons for the expert's opinion;
- data and information on which the opinion is based;
- exhibits to be used to support the opinion;
- a curriculum vitae or resume
- all publications within the past 10 years;
- compensation to be paid for the study and testimony; and
- a listing of previous cases in which the expert had testified (either at trial or deposition) within the preceding 4 years.

The due date of expert disclosures is (unless the court alters it):

- initial expert testimony: At least 90 days before trial



- rebutting expert testimony: (responding to initial testimony): Within 30 days of the initial expert disclosure.

Pretrial Disclosure - for any evidence to be used at trial, a party shall disclose:

- The name, address, phone number of each witness and the subject matter of their testimony (if not already provided), separately indicating which witnesses may appear at trial and which may not.
- Designation of witnesses whose testimony is expected by deposition.
- Appropriate identification of each document and exhibit, and summaries of evidence.

### **Other Disclosure Rules:**

- Pretrial disclosure must be submitted at least 30 days before trial.

Within 14 days after pretrial disclosure, a party may file a list disclosing:

- Any objections to the use of depositions
- Any objections to the admissibility of materials (with a reason for the objection)
- If objections are not made before 14 days, they are deemed to be waived, unless the omission is excused for good cause.

### **Trial Preparation; Obtaining Expert Opinions:**

#### **Federal Rules**

#### **Depositions:**

- Depositions of any person identified as an expert may be taken and may be used at trial.
- If an Expert Disclosure Report is required (by local rules), the deposition shall be conducted after the report is received.
- Other Parties' Experts: Parties may discover known facts, or opinions of another parties' experts (via deposition or interrogatories) who are not expected to be used at trial, but only if the parties show exceptional circumstances that make it impractical for them to obtain the expert information by hiring an expert on their own.

### Payment of Experts:

The court shall require the party requesting the information to pay the expert, unless manifest injustice will result:

- A reasonable fee for her time spent responding to the discovery requests; and
- A reasonable portion of the expert's fee to the other party for the expert opinions obtained.

6. FED. R. CIV. P. 26 (a)(2)(A).
7. *See e.g.*, Santiago-Lampon v. Real Legacy Assurance Co., 293 F.R.D. 86 (D.P.R. 2013).
8. *See e.g.*, Esposito v. Home Depot U.S.A., Inc., 590 F.3d 72 (1st Cir. 2009)
9. FED. R. CIV. P. 26(a)(2)(B).
10. *Id.*
11. FED. R. CIV. P. 26 (2) (B) Witnesses Who Must Provide a Written Report. Unless otherwise stipulated or ordered by the court, this disclosure must be accompanied by a written report--prepared and signed by the witness--if the witness is one retained or specially employed to provide expert testimony in the case or one whose duties as the party's employee regularly involve giving expert testimony. The report must contain:
  - (i) a complete statement of all opinions the witness will express and the basis and reasons for them;
  - (ii) the facts or data considered by the witness in forming them;
  - (iii) any exhibits that will be used to summarize or support them;
  - (iv) the witness's qualifications, including a list of all publications authored in the previous 10 years;
  - (v) a list of all other cases in which, during the previous 4 years, the witness testified as an expert at trial or by deposition; and
  - (vi) a statement of the compensation to be paid for the study and testimony in the case.
12. FED. R. CIV. P. (2) (C) Witnesses Who Do Not Provide a Written Report. Unless otherwise stipulated or ordered by the court, if the witness is not required to provide a written report, this disclosure must state:



- (i) the subject matter on which the witness is expected to present evidence under Federal Rule of Evidence 702, 703, or 705; and
  - (ii) a summary of the facts and opinions to which the witness is expected to testify.
13. *Kondragunta v. Ace Doran Hauling & Rigging Co.*, No. 1:11-CV-01094-JEC, 2013 WL 1189493, at \*10 (N.D. Ga. Mar. 21, 2013).
  14. FED. R. CIV. P. 26(a)(2)(B).
  15. FED. R. CIV. P. 26(a)(2)(C).
  16. *Gen. Elec. Co. v. Joiner*, 522 U.S. 136 (1997).
  17. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U. S. 579 (1993).
  18. *Joiner*, *supra* note 16, 522 U.S. at 146.
  19. Federal Rules of Evidence, Rule 104. Preliminary Questions (a) In General. The court must decide any preliminary question about whether a witness is qualified, a privilege exists, or evidence is admissible. In so deciding, the court is not bound by evidence rules, except those on privilege. [https://www.law.cornell.edu/rules/fre/rule\\_104](https://www.law.cornell.edu/rules/fre/rule_104)
  20. *See e.g.*, *Ruffin ex rel. Sanders v. Boler*, 890 N.E.2d 1174 (Ill. 2008); *Sean R. ex rel. Debra R. v. BMW of N. Am., LLC*, 48 N.E.3d 937, 941 (N.Y. 2016); *Roberti v. Andy's Termite & Pest Control, Inc.*, 113 Cal. App. 4th 893 (2003).
  21. *See e.g.* *People v. McKown*, 924 N.E.2d 941, 950 (Ill. 2010).
  22. *See e.g.* *People v. Wesley*, 633 N.E.2d 451, 454 (N.Y. 1994).
  23. *See* Section 4, Statistics of this Bench Book.
  24. Bruce Parker, *Effective Strategies For Closing The Door On Junk Science Experts*, DEFENSE COUNSEL JOURNAL, (1998) <https://www.venable.com/files/Publication/cf64a2e3-b8fa-45b9-837c-f7064b8a5163/Presentation/PublicationAttachment/b9105023-1194-467b-879b-111ff29c5a0b/1138.pdf>
  25. *See*, REBECCA C. HARRIS, *BLACK ROBES, WHITE COATS: THE PUZZLE OF JUDICIAL POLICYMAKING AND SCIENTIFIC EVIDENCE* (Rutgers Univ. Press 2008); *see also*, George D. Marlow, *Black Robes to White Lab Coats: The Ethical Implications of a Judge's Sua Sponte, Ex Parte Acquisition of Social and Other Scientific Evidence During*

*the Decision Making Process*, 72 St. JOHN'S L. REV. 291 (Spring 1998); Edward K. Cheng, *Independent Judicial Research in the Daubert Age*, 56 DUKE L.J. 1263 (March 2007).

26. Sean R. ex rel. Debra R. v. BMW of N. Am., LLC, 48 N.E.3d 937, 941 (N.Y. 2016).
27. People v. Kelly, 549 P.2d 1240 (CA 1976).
28. E.I. du Pont de Nemours and Co., Inc. v. Robinson, 923 S.W.2d 549 (Tex. 1995).
29. See Section 3.10 Forensic Pattern Evidence. and Section 3.11 Forensic Analytical Evidence of this Bench Book.





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# 6. PRE-TRIAL CRIMINAL

## Section 6.1 Pre-Trial Supervision

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**HON. VERONICA ALICEA-GALVAN**

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### 6.1.1 Introduction

Predicting human behavior has been a scientific pursuit since the inception of civilization. From weighing down suspected witches with stones, to forecasting the likelihood of criminal conduct by measuring a forehead or classifying physical features, science has sought to provide tools upon which we can reasonably rely in the interest of community safety. While today “scientific” studies such as phrenology<sup>1</sup> are considered absurd, years ago these scientific hypotheses were used to justify many of the policies and practices of our criminal justice system. That being said, science and technology can provide us with tools to assist judicial officers in weighing community interests of safety with those of an individual’s right to be free of restraints. In this section we will explore the pros and cons of monitoring technology in the pre-trial context. We will also discuss the use of predictive technology, such as pre-trial risk assessments, and what courts should consider before using these tools.

Monitoring Technology can generally be classified into two categories--location monitoring and substance use monitoring.

### 6.1.2 Location Monitoring Technology

Location monitoring technology is used to ensure that an individual stays in a dedicated place, i.e. home, or can ensure someone does not go near a certain person or place.

**Electronic Home Monitoring (EHM) or Electronic Home Detention (EHD)** may be used both in the pretrial and post-conviction arena.

**Pros:** Allows an individual to remain in the community where they may work, access support systems, provide support for their families, or attend school, while being monitored through electronic means. Use of this technology may also help address overcrowding issues in local jails saving local jurisdictions money and resources.

**Cons:** Does not, in and of itself, prohibit individuals from engaging in other criminal conduct within the confines of the permitted

location, nor from ingesting lawful or unlawful substances absent additional monitoring capabilities. Escape is as easy as cutting off the monitoring device. Requires staffing to monitor individuals on release.

**Global Positioning Systems (GPS)** can provide 24 hour location monitoring for individuals.

**Pros** - The same as EHM and EHD, but provides a little more freedom of movement. Additionally, GPS may assist in ensuring compliance with distance restrictions from certain locales such as schools, residences or work areas. It is particularly useful in situations involving sex offenders, or in domestic violence cases.

**Cons** - Same as EHM and EHD. As with all technologies, maintenance and potential malfunctions are always a concern.

### 6.1.3 Substance Use Monitoring

Substance Use Monitoring is often a way to ensure that an individual is abstaining from using both legal and illicit substances. This type of monitoring is often used in cases of driving while impaired but can also be helpful in other instances where there is a nexus between use of the substances and the underlying criminal conduct.

Transdermal alcohol monitoring systems, breath testing, ignition interlock devices (IID), urinalysis, and hair follicle testing are the least invasive methods to ensure individuals are not using alcohol or non-prescribed mood altering substances. Other more invasive methodologies for measuring substance use, i.e., blood tests, exist, however may not necessarily be appropriate in the pre-trial context.

**Transdermal alcohol monitoring** allows for continuous monitoring of alcohol consumption and is based upon measuring alcohol secreted through the skin.<sup>2</sup>

**Pros** - This type of monitoring is continuous as opposed to a specific point in time. As such, a broader picture of use is developed. This type of monitoring can easily be combined with GPS, IID or EHM



monitoring. The monitors must be worn at all times but can be less obtrusive than other monitors. They may act as an inhibitor when the individual knows that monitoring is constant.

**Cons** - At this time, only alcohol use is measured. They cannot account for use of other substances and reporting time may lag behind an actual consumption event. They do not, standing alone, prohibit an individual from driving a vehicle or engaging in other criminal conduct. Malfunctioning devices or user error may cause erroneous results. They may require the individual to have a cell phone or land line to download results on a regular basis.

**Breath testing** allows for random checks for alcohol consumption events.

**Pros**- Breath testing instruments are ubiquitous and easy to use. They can be used at home and randomized so an individual does not know when they will be required to provide a sample; alternatively they can be used on demand or on a particular schedule. They can be used in conjunction with other monitoring devices such as IID, GPS and EHM. They provide easy access and results are downloaded quickly when the test is completed. They can also be done promptly at a set location pre-determined by the jurisdiction, i.e., probation office.

**Cons** – They can malfunction, there can be user error, they require individuals to have certain devices available to download information or may require them to travel to and from a facility. They do not prohibit driving or criminal conduct.

**IIDs** prevent a vehicle from starting if the device detects pre-set levels of alcohol as measured through a breathalyzer or transdermal monitoring.

**Pros** – IIDs prevent driving of a vehicle if the individual has an alcohol concentration above set standards. They can also be equipped with a camera to show who is blowing into the machine.

**Cons** – They can malfunction. There is always a danger of circumventing the mechanism by having others blow into machine or disconnecting it altogether. However, tampering should be detected by the device’s monitoring system.

#### 6.1.4 Risk Assessment Tool

The most ubiquitous form of predictive technology used in the criminal pretrial context is the **risk assessment tool**. The risk assessment tool uses demographic data and algorithms to provide information regarding the “risk” (high, low, moderate) associated with releasing an individual charged with a criminal offense.<sup>3</sup>

**Pros** – Pre-trial risk assessment tools provide additional information for the court to consider in making release decisions and have been shown to be better predictors of risk than judicial decision making alone. These tools can also lead to better outcomes across varied populations.<sup>4</sup>

**Cons** – Release decisions need to be individualized, and the PTRAs currently available use aggregated data to provide an analysis of risk. There are significant concerns that bias and disproportionality that have been a part of our justice system are baked in to such a degree, that the data relied upon by these tools is suspect. A tool that works for one jurisdiction may not work for another; a lot of preliminary work should be engaged in before deciding what, if any, PTRAs a jurisdiction will use.<sup>5</sup>

Science and technology are tools in the arsenal of justice that continue to evolve. As artificial intelligence, predictive analytics, and monitoring technologies become more accurate and easier to use, it is tempting to think that judicial discretion will go the way of the dinosaurs. However, we need not hang up our black robes quite yet. As judicial officers, we are still in the best position to ascertain and address the unpredictability of the human element that we see in our courts daily. We are not yet at the point where we ask “Hey Siri, what pretrial conditions should I impose?” Our own humanity continues to be the greatest tool we own.



### 6.1.5 Endnotes

1. Phrenology is defined as the detailed study of the size and shape of the cranium as an indication of character and mental abilities used to predict criminality of certain individuals.
2. Nancy P. Barnett, et al., *Predictors of Detection of Alcohol Use Episodes Using a Transdermal Alcohol Sensor*, 22 EXPERIMENTAL & CLINICAL PSYCHOPHARMACOLOGY 1, 86-96 (2014).
3. Phillip Knox & Peter Keifer, *The Risks and Rewards of Risk Assessments*, TRENDS IN ST. CTS., (2017) <https://www.ncsc.org/sitecore/content/microsites/trends/home/Monthly-Trends-Articles/2017/The-Risks-and-Rewards-of-Risk-Assessments.aspx>
4. National Institute of Corrections Community Collaborative Network, Series 2, Project number 16C5012, (March 2017), <https://nicic.gov/library/032859>.
5. Intisar Surur & Andrea Valdez, *Washington State Pretrial Reform Task Force: Final Recommendations Report*, (February, 2019), <http://www.courts.wa.gov/subsite/mjc/docs/PretrialReformTaskForceReport.pdf>



An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. Scattered throughout the background are small, light-colored numbers (0-9) in a random distribution.

# 6. PRE-TRIAL CRIMINAL

## Section 6.2 Pre-Trial Discovery

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**HON. LOUIS B. BUTLER, JR. (RET.)**

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### 6.2.1 Introduction

This portion of the Bench Book, addressing general rules of discovery, consists of three parts:

- 6.2.2 General rules of discovery and inspection, which can vary from state to state.
- 6.2.3 When discovery motions need to be filed by either statute or court rule.
- 6.2.4 The types of discovery provided.

A trial judge should be aware that while many jurisdictions have discovery rules that are similar in scope and design, there are differences and nuances that the judge needs to be aware of in using this Bench Book. For uniformity's sake, this section largely tracks the federal rules. Each judge needs to follow the rules of his or her own jurisdiction.

For a sampling of Discovery Orders, see *Appendix 2*.

### 6.2.2 General

“Discovery” is a term used to refer to the legal process by which parties in litigation obtain information from each other. In criminal cases, discovery is generally much more limited than in civil cases. Most states recognize a “clear legal right” to pretrial discovery by statute, but there is no federal constitutional right to discovery.<sup>1</sup> Discovery emphasizes the defendant’s right of access to evidence necessary to prepare a defense, which is not constitutional. Disclosure, on the other hand, emphasizes the state’s duty to disclose exculpatory evidence to a defendant, and may be constitutional as decided on a case-by-case basis.

Federal criminal discovery is generally governed by Rule 16 of the Federal Rules of Criminal Procedure (“FRCP”) and Supreme Court cases governing evidence that materially exonerates the defendant. Under FRCP Rule 16, once a defendant makes

a demand for discovery on the government, the government is required to produce items such as the defendant's oral, written, and recorded statements, criminal record, reports of examinations and tests, documents or other physical objects the government intends to introduce at trial, expert witnesses, and more. In state prosecutions, limited discovery and inspection is generally provided for by state statutes and/or court rules.

A prosecutor has no constitutional duty to routinely allow the inspection of or deliver the entire prosecution file to defense counsel.<sup>2</sup>

Some jurisdictions have a standing order on pretrial discovery requiring government disclosure of all material covered by the discovery rules, statutes, and state and federal constitutions, called an "Open File Policy."<sup>3</sup> Under that policy, the government would disclose, without defense motion, all information and materials listed in FRCP 16(a)(1)(A), (B), (C), (D), (E), and (F). That includes the defendant's oral, written, and recorded statements, prior criminal record, reports of examinations and tests, and documents or other physical objects that is in the government's possession, custody or control and that the government intends to introduce at trial. Unless these items include exculpatory material, open file materials do not ordinarily include material under FRCP 16(a)(1)(G) (which governs written summaries of expert witnesses), government attorney work product and opinions, privileged materials, material identifying confidential informants, or reports of witnesses who will not be called in the government's case-in-chief and grand jury transcripts. The government retains authority to redact from the open file material anything that is:

1. Not exculpatory
2. Not relevant to the prosecution
3. Would jeopardize safety of someone other than defendant
4. Would jeopardize an ongoing criminal investigation.

In all jurisdictions, regardless of whether an open file policy is in place or not, disclosure is required as a matter of due process, when evidence is in exclusive possession of state, and:



1. Such evidence is favorable to the accused;<sup>4</sup> and,
2. Such evidence is material to either guilt or punishment for purposes of trial.<sup>5</sup>

The *Brady* rule concerning exculpatory evidence is inapplicable at the guilty plea stage.<sup>6</sup> Evidence that goes to the credibility of state's witnesses is considered exculpatory under *Brady*.<sup>7</sup> The *Brady* rule also includes impeachment evidence.<sup>8</sup> This includes evidence known to the police, even if not known by the prosecutor.<sup>9</sup> The *Brady* rule includes *in camera* inspection of confidential records by the trial judge to determine whether potential evidence contains exculpatory information.<sup>10</sup> The duty of the state to disclose applies whether defendant makes no request for exculpatory information, a general request, or a specific request, and the state is not the arbiter of weight, credibility, and exculpatory nature of the evidence.<sup>11</sup> Exculpatory evidence must be made available to defense in time to make reasonable use of it.<sup>12</sup>

*There is no duty for a state (absent a local rule) to preserve specimen samples, even if useful to the defendant*

### 6.2.3 Timing of Statutory or Court Rule Discovery Motions

Specific deadlines for discovery demand and discovery motions depend on the jurisdiction. They are set by statute, court rule, or local rule, and may be different for felonies and misdemeanors. They will often be included in the trial court's scheduling order. Generally, discovery demands must be made before trial, with the court setting the deadline at or shortly after the arraignment for parties to make pretrial motions. The court may extend time for filing motions, but if a party does not meet the deadline for filing pretrial motion for discovery, the motion is considered untimely. The motion may be considered by the court if good cause is shown.



## 6.2.4 Types of Statutory or Court Rule Discovery Provided

### 6.2.4.1 *Discovery Allowed*

The government has a duty to disclose to defendant, upon request, within reasonable time before trial if within possession, custody, or control of the government, the following:

1. The substance of any relevant oral statement made by defendant.<sup>13</sup>
2. Any written or recorded statement by defendant.<sup>14</sup>
3. Depending on the rules for each jurisdiction, any written summaries of all oral statements of defendant intended to be used at trial and names of witnesses to those statements.
4. Defendant's prior criminal record.<sup>15</sup>
5. Depending on the rules for each jurisdiction, a list of all witnesses and their addresses, except those to be called for impeachment or rebuttal.
6. Depending on the rules for your jurisdiction, any relevant or recorded statements of witnesses to be called at trial.<sup>16</sup>
7. Permit defendant to inspect and copy or photograph books, papers, documents, photographs, tangible objects, buildings or places, or copies or portions thereof if:
  - a. the item is material to the defense;
  - b. state intends to use in case-in-chief, or
  - c. was obtained from or belongs to defendant.<sup>17</sup>
8. There is no duty for state (absent a local rule) to preserve specimen samples, even if useful to defendant, unless defendant shows:
  - a. bad faith destruction by state,

- b. evidence had apparent exculpatory value prior to its destruction, and
  - c. no comparable evidence on same subject matter is available to defendant.<sup>18</sup>
- 9. Permit defendant to inspect and copy or photograph the results or reports of any physical or mental examination and of any scientific test or experiment if:
  - a. item is within state's possession, custody, or control;
  - b. the attorney for state knows or should have known of the item exists; and
  - c. item is material to defense or state intends to use item in case-in-chief.<sup>19</sup>
- 10. Written summary of any expert testimony state intends to use at trial during its case in chief under rules of evidence, and must include the witness's opinions, the bases and reasons for those opinions, and the witness's qualifications.<sup>20</sup>
  - a. Witness who is qualified as an expert by knowledge, skill, experience, training, or education may give opinion testimony if:
    - i. expert's scientific, technical, or other specialized knowledge will assist trier of fact;
    - ii. testimony is based on sufficient facts or data;
    - iii. testimony is product of reliable principles and methods; and,
    - iv. expert has reliably applied the principles and methods to the facts of the case.<sup>21</sup>
  - b. Expert opinion may be based on facts or data in the case that the expert has been made aware of or personally observed.

- i. Facts or data need not be admissible for opinion to be admitted if reasonably relied upon by expert in forming opinion;
- ii. If facts or data would otherwise be inadmissible, the proponent of the opinion may disclose them to the jury only if probative value substantially outweighs their prejudicial effect; and,
- iii. Unless court orders otherwise, an expert may state an opinion, including the reasons for it, without first testifying to the underlying facts or data, but may be required to disclose those facts or data on cross-examination.<sup>22</sup>

#### 6.2.4.2 *Reciprocal Discovery*

The defendant has a reciprocal duty to the state within a reasonable time before trial, to permit state to inspect and copy or photograph books, papers, documents, data, photographs, tangible objects, buildings or places, or copies or portions thereof, if the item is within the defendant's possession, custody, or control, and the defendant intends to use the item in defendant's case-in-chief at trial.<sup>23</sup>

The defendant is also required to permit the state to inspect and copy or photograph the results or reports of any physical or mental exam and of any scientific test or experiment, if the item is within the defendant's possession, custody, or control; and the defendant intends to use the item in defendant's case-in-chief at trial, or intends to call the witness who prepared the report and the report relates to the witness's testimony.<sup>24</sup>

Defendant must, upon request, give to the state a written summary of the expert testimony the defendant intends to use at trial, and must include the expert witness's opinions, the bases and reasons for those opinions, and the witness's qualifications.<sup>25</sup>

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may give opinion testimony if:

- 1. expert's scientific, technical, or other specialized knowledge will assist trier of fact;

2. testimony is based on sufficient facts or data;
3. testimony is product of reliable principles and methods; and,
4. expert has reliably applied the principles and methods to the facts of the case.<sup>26</sup>

Depending on the jurisdiction, defendant may be required to produce a list of all witness to be used in the defendant's case-in-chief, which may include any relevant written or recorded statements of a witness, and the criminal record of any defense witness.

The attorney-client privilege and work-product doctrine limit states' rights to reciprocal discovery.<sup>27</sup> However, requiring disclosure of a defense investigator's report before allowing the investigator to testify to impeach a prosecution witness does not violate the Fifth or Sixth Amendments nor the work product rule.<sup>28</sup>

### 6.2.5 Protective Order

At any time, upon motion of either party, the court may, for good cause, order that discovery, inspection, or the listing of witnesses be denied, restricted, or deferred. The court may permit a party to show good cause by a written statement to be inspected by the court *ex parte*. If relief is granted, the court must preserve the entire text of the party's statement under seal.<sup>29</sup> If a party fails to comply with the rules, the court may order that party to permit the discovery or inspection, grant a continuance, prohibit that party from introducing the undisclosed evidence, or enter any other order that is just under the circumstances.<sup>30</sup> The court may exclude any witness not listed or evidence not presented for inspection or copying that is required unless good cause is shown for failure to comply.<sup>31</sup> The Court may also advise the jury of any failure or refusal to disclose by way of jury instruction.<sup>32</sup>

### 6.2.6. Continuing Duty to Disclose

If before or during trial, a party discovers additional material or the names of additional witnesses which are subject to discovery, inspection, or production, that party shall promptly notify the other party of its existence.<sup>33</sup>



### 6.2.7 Endnotes

1. Weatherford v. Bursey, 429 U.S. 545 (1977).
2. Arizona v. Youngblood, 488 U.S. 51 (1988); United States v. Agurs, 427 U.S. 97, 106 (1976).
3. See, e.g., United States District Court for the Eastern District of Wisconsin Local Rule 16(a), as amended September 9, 2015.
4. Agurs, 427 U.S. at 112-113. (Prosecution must affirmatively ascertain).
5. Brady v. Maryland, 373 U.S. 83 (1963).
6. United States v. Vonn, 535 U.S. 55 (2002).
7. Giglio v. U.S., 405 U.S. 150 (1972).
8. United States v. Bagley, 473 U.S. 667 (1985).
9. Youngblood v. West Virginia, 547 U.S. 867 (2006).
10. Pennsylvania v. Ritchie, 480 U.S. 39 (1987)
11. Kyles v. Whitley, 514 U.S. 419 (1995).
12. U.S. v. Pollack, 534 F.2d 964 (D.C. Cir. 1976).
13. Compare Fed. R. Civ. P. 16(a)(1)(A).
14. Compare Fed. R. Civ. P. 16(a)(1)(B).
15. Compare Fed. R. Civ. P. 16(a)(1)(D).
16. But see 18 U.S.C §3500, for federal rule that disclosure is not required until the witness has testified on direct examination.
17. Compare Fed. R. Civ. P. 16(a)(1)(E).
18. California v. Trombetta, 467 U.S. 479 (1984).
19. Compare Fed. R. Civ. P. 16(a)(1)(E).
20. Compare Fed. R. Civ. P. 16(a)(1)(G).
21. See Section 7. Trial.
22. Id.



23. *Compare* Fed. R. Civ. P. 16(b)(1)(A).
24. *Compare* Fed. R. Civ. P. 16(b)(1)(B).
25. *Compare* Fed. R. Civ. P. 16(b)(1)(C).
26. *See* Section 7. *Trial*.
27. *Upjohn Co. v. United States*, 449 U.S. 383 (1981).
28. *United States v. Nobles*, 422 U.S. 225 (1975).
29. *Compare* Fed. R. Civ. P. 16(d)(1).
30. *Compare* Fed. R. Civ. P. 16(d)(2).
31. *Taylor v. Illinois*, 484 U.S. 400 (1988).
32. *Id.*
33. *Compare* Fed. R. Civ. P. 16(c).





# 7. TRIAL

Sections 7.1 - 7.5

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**HON. SAMUEL A. THUMMA**

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## 7.1 INTRODUCTION

This portion of the Bench Book, addressing admissibility, consists of three parts:

7.2 The History of The Judicial Gatekeeper Function, tracing the evolution of the standards for admission of expert testimony (including *Frye*, *Daubert* and Federal Rule of Evidence 702) and concludes with a chart comparing key distinctions between *Frye* and *Daubert*.

7.3 Evaluating Admissibility of Expert Evidence and Scientific Evidence, including a corresponding flowchart which, based on the Federal Rules of Evidence, addresses important: (1) legal issues; (2) procedural issues; and, (3) specific factors to be considered by the trial judge in determining admissibility of such evidence.

7.4 Admissibility vs. Weight, addressing the important differences between these two concepts.

*A trial judge lacking time to review all three parts will best be served by turning directly to Section 7.2, and the corresponding flowchart, which provides guidance on specific concepts and tools to aid in resolving specific admissibility issues.*

A trial judge lacking time to review all three parts will best be served by turning directly to Section 7.3, and the corresponding flowchart, which provides guidance on specific concepts and tools to aid in resolving specific admissibility issues.



## 7.2 THE HISTORY OF THE JUDICIAL GATEKEEPER FUNCTION

### 7.2.1 *Frye v. United States*

The Federal Rules of Evidence (FRE) were adopted effective July 1, 1975 and have now been in place for more than forty years. For two centuries preceding the adoption of the FRE, the admissibility of evidence in most courts in the United States was governed by case law, or at times statutory provisions, not by a set of rules. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923) was a seminal case addressing the admissibility of expert testimony, decided more than fifty years before the adoption of the FRE. *Frye* was an appeal from a murder conviction where the defendant argued the trial court erred in excluding “an expert witness to testify to the result of a deception test made upon defendant” that indicated defendant’s confession was false.<sup>1</sup> The brevity of *Frye* merits quoting significant portions here.

*Frye* first described in some detail the proffered basis of the “systolic blood pressure deception test” at issue, followed by an observation that:

the theory seems to be that truth is spontaneous, and comes without conscious effort, while the utterance of a falsehood requires a conscious effort, which is reflected in the blood pressure. The rise thus produced is easily detected and distinguished from the rise produced by mere fear of the examination itself. In the former instance, the pressure rises higher than in the latter, and is more pronounced as the examination proceeds, while in the latter case, if the subject is telling the truth, the pressure registers highest at the beginning of the examination, and gradually diminishes as the examination proceeds.<sup>2</sup>

Before trial, defendant “was subjected to this deception test” by his expert, Dr. William Moulton Marston.<sup>3</sup> When defendant sought to have Dr. Marston testify at trial “to the results obtained,” the government objected, and the trial court sustained that objection.<sup>4</sup> Defendant offered to have Dr. Marston “conduct a test in the presence of the jury. This also was denied.”<sup>5</sup> After a guilty verdict, the defendant appealed from his murder conviction.



On appeal, *Frye* noted the admissibility issue was a “novel question” and “no cases directly in point have been found.”<sup>6</sup> *Frye* next quoted defendant’s brief on appeal for the following propositions:

The rule is that the opinions of experts or skilled witnesses are admissible in evidence in those cases in which the matter of inquiry is such that inexperienced persons are unlikely to prove capable of forming a correct judgment upon it, for the reason that the subject-matter so far partakes of a science, art, or trade as to require a previous habit or experience or study in it, in order to acquire a knowledge of it. When the question involved does not lie within the range of common experience or common knowledge, but requires special experience or special knowledge, then the opinions of witnesses skilled in that particular science, art, or trade to which the question relates are admissible in evidence.<sup>7</sup>

The next paragraph from the opinion contains what became the standard for the admissibility of novel scientific evidence – the “*Frye* test” – in many courts for many decades to follow:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.<sup>8</sup>

Stated differently, to be admissible under the *Frye* test, the proponent of novel scientific evidence was required to show:

1. general acceptance
2. in the relevant scientific community (and also, as with any evidence, relevance, proper foundation and that the novel scientific evidence was not otherwise excluded from evidence).





As noted decades later, *Frye* is “one of the bigger mysteries in American legal history. The appeals court’s opinion, only 641 words long, contains not a single reference to case law or precedent, nor any references to any scientific literature.”<sup>9</sup> *Frye*, however, “is a landmark in the law of evidence and one of the most cited cases in the history of American law.”<sup>10</sup>

### 7.2.2 Federal Rule of Evidence 702 (1975-2000)

Many years in the making, in January 1975, President Gerald Ford signed the Federal Rules of Evidence (FRE) into law effective July 1, 1975.<sup>11</sup> The FRE contain six rules addressing opinion and expert testimony (Rules 701-706), with Rule 702 governing the admissibility of expert evidence. As originally promulgated in 1975, that rule contained a single sentence and read as follows:

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.<sup>12</sup>

Although not expressly mentioning “general acceptance” or *Frye*, for nearly two decades after the adoption of Rule 702, *Frye* “continue[d] to be followed by a majority of courts.”<sup>13</sup> The United States Supreme Court would change that in its 1993 *Daubert* decision.

### 7.2.3 The *Daubert* Trilogy.

Plaintiffs in *Daubert* were minor children born with serious birth defects who sued Merrell Dow Pharmaceuticals claiming that their mothers’ use of Bendectin, an anti-nausea drug, caused their birth defects.<sup>14</sup> The issue addressed by the United States Supreme Court in *Daubert* arose out of the admissibility, under Rule 702 as it read at the time, of testimony from plaintiffs’ experts that Bendectin can cause birth defects.<sup>15</sup> Plaintiffs argued “that the *Frye* test was superseded by the adoption of the Federal Rules of Evidence.”<sup>16</sup> In *Daubert*, the United States Supreme Court agreed that the adoption of Rule 702, 18 years earlier, superseded *Frye*, at least in part.<sup>17</sup>

*Daubert* first noted Rule 702 did not “establish ‘general acceptance’ as an absolute prerequisite to admissibility,” adding that Merrell Dow did not “present any clear indication that Rule 702 or the Rules as a whole were intended to incorporate a ‘general acceptance’ standard.”<sup>18</sup> “*Frye* made ‘general acceptance’ the exclusive test for admitting expert scientific testimony. That austere standard, absent from, and incompatible with, the Federal Rules of Evidence, should not be applied in federal trials.”<sup>19</sup>

If not *Frye*, what standard did apply? *Daubert* noted that under the Federal Rules of Evidence, “the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable,” adding that “the requirement that an expert’s testimony pertain to ‘scientific knowledge’ establishes a standard of evidentiary reliability.”<sup>20</sup> “Rule 702’s ‘helpfulness’ standard [also] requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility.”<sup>21</sup> This, *Daubert* found, means:

Faced with a proffer of expert scientific testimony, then, the trial judge must determine at the outset, pursuant to Rule 104(a), whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails 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. We are confident that federal judges possess the capacity to undertake this review. Many factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test. But some general observations are appropriate.<sup>22</sup>

*Daubert* then set forth **non-exclusive** factors to determine the admissibility of expert evidence:

- **Testing:** “Ordinarily, a key question to be answered in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested.”<sup>23</sup>



- **Peer Review and Publication:** “Another pertinent consideration is whether the theory or technique has been subjected to peer review and publication . . . . The fact of publication (or lack thereof) in a peer reviewed journal thus will be a relevant, though not dispositive, consideration in assessing the scientific validity of a particular technique or methodology on which an opinion is premised.”<sup>24</sup>
- **Error Rate:** “[I]n the case of a particular scientific technique, the court ordinarily should consider the known or potential rate of error.”<sup>25</sup>
- **Standards and Controls:** “[I]n the case of a particular scientific technique, the court [also] ordinarily should consider . . . the existence and maintenance of standards controlling the technique’s operation.”<sup>26</sup>
- **General Acceptance:** “Finally, ‘general acceptance’ can yet have a bearing on the inquiry. A ‘reliability assessment does not require, although it does permit, explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community.’ Widespread acceptance can be an important factor in ruling particular evidence admissible, and ‘a known technique which has been able to attract only minimal support within the community,’ may properly be viewed with skepticism.”<sup>27</sup>

In setting forth these non-exclusive factors, *Daubert* emphasized that the Rule 702 inquiry is “a flexible one,” adding that the “overarching subject is the scientific validity of—and thus the relevance and reliability—of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions they generate.”<sup>28</sup> The judge also must perform the Rule 403 balancing analysis<sup>29</sup> when faced with an objection.<sup>30</sup>

*Daubert* also offered other guidance in the admissibility of expert testimony, including:

- “Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.”<sup>31</sup>
- “[I]n the event the trial court concludes that the scintilla of evidence presented supporting a position is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to direct a judgment, and likewise to grant summary judgment. These conventional devices, rather than wholesale exclusion under an uncompromising ‘general acceptance’ test, are the appropriate safeguards where the basis of scientific testimony meets the standards of Rule 702.”<sup>32</sup>
- “We recognize that, in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.”<sup>33</sup>

Although resolving some key issues, *Daubert* left open several others, including the appropriate standard of review on appeal for the decision on the admissibility of expert testimony and whether the standards in *Daubert* applied to all expert evidence offered under Rule 702 or only novel scientific evidence. A few years later, the United States Supreme Court held “that abuse of discretion is the appropriate standard” for an appellate court to use in reviewing a trial court’s decision regarding admissibility under *Daubert*.<sup>34</sup> Two years after that, the United States Supreme Court held, in *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), “that *Daubert*’s general holding—setting forth the trial judge’s general ‘gatekeeping’ obligation—applies not only to testimony based on ‘scientific’ knowledge, but also to testimony based on ‘technical’ and ‘other specialized’ knowledge.”<sup>35</sup>



### 7.2.4 Federal Rule of Evidence 702 (2000-Present)

As a result of this “*Daubert* Trilogy” – *Daubert*, *Joiner* and *Kumho Tire* – Rule 702 was amended in 2000, and then restyled in 2011, so that the current version reads as follows:

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:

- (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 the principles and methods to the facts of the case.<sup>36</sup>

The Committee Notes on Rules – 2000 Amendment for Rule 702 are lengthy, rich with citations and, although not repeated here, merit reference based on the needs of the specific case.

### 7.2.5 *Frye* vs. *Daubert*: A Summary Comparison

Stated briefly, and without accounting for jurisdiction-specific differences that may exist, the comparisons between *Frye* and *Daubert* on several important issues can be summarized as follows:



## ***FRYE VS. DAUBERT SUMMARY COMPARISON TABLE***

Topic	<i>Frye</i>	<i>Daubert</i>
Applicability	Limited to “novel scientific evidence”	All expert evidence subject to Fed. R. Evid. 702.
Standard for admissibility	“Generally accepted in the relevant scientific community.”	Text of the rule plus non-exclusive factors.
Standard of review on appeal	De novo	Abuse of discretion
Applicability to other/ subsequent cases	When admissibility resolved by binding appellate decision, resolved for all future cases (provided proper foundation is shown and evidence is otherwise admissible)	Case-by-case decision

TABLE 7.1

## 7.3 EVALUATING ADMISSIBILITY OF EXPERT EVIDENCE AND SCIENTIFIC EVIDENCE

The admissibility of expert evidence and scientific evidence can involve (1) legal issues; (2) procedural issues; and, (3) specific factors to be considered. Although the separateness of these categories is not pristine, these categories help in identifying the applicable legal rules and in addressing issues involved in determining admissibility. The following Subsections address these three categories separately, recognizing they are interrelated and build on each other.

### 7.3.1 Legal Issues.<sup>37</sup>

#### *7.3.1.1 Is the Proffered Evidence Opinion Evidence?*

The first legal issue to consider is whether the proffered evidence is opinion evidence. If the evidence is opinion evidence, various Federal Rules of Evidence in the 700 series may be helpful in deciding admissibility.<sup>38</sup> If the evidence is not opinion evidence, the evidence may (or may not) be admissible, but unless an expert seeks to testify “otherwise” than in the form of an opinion, the rules regarding the admission of such evidence are found outside of the 700 series of the Federal Rules of Evidence.

#### *7.3.1.2 Is the Proffered Opinion Evidence By An Expert (As Opposed To Opinion By A Lay) Witness?*

Admissibility of opinion evidence by a lay witness is governed by Fed. R. Evid. 701, while admissibility of opinion evidence by an expert witness is governed by Fed. R. Evid. 702. Accordingly, an important legal issue is whether the proffered opinion evidence is from a lay witness or an expert witness.

The proffered evidence is from an expert witness if such a person is qualified as such “by knowledge, skill, experience, training, or education” and testifies based on “scientific, technical, or other specialized knowledge.”<sup>39</sup> Admissibility of expert opinion evidence is governed by Rule 702, which is discussed in detail below. By

contrast, the proffered opinion evidence is from a lay witness if the witness “is not testifying as an expert” and “not based on scientific, technical, or other specialized knowledge within the scope of Rule 702.”<sup>40</sup> Stated differently, lay witness opinion evidence is defined as what is not expert witness opinion evidence and its admissibility is governed by Rule 701. Using these definitions to determine whether the proffered opinion evidence is from a lay witness or an expert witness is essential in knowing which of these two different standards to apply.

### *7.3.1.3 Is the Proffered Expert Evidence Relevant?*

To be admissible, all proffered evidence must be relevant to prove or disprove a disputed fact of consequence,<sup>41</sup> given that “[i]rrelevant evidence is not admissible.”<sup>42</sup> This same standard applies with full force to expert evidence. As discussed more fully below, along with this general relevance standard, the proffered expert opinion evidence also must “help the trier of fact to understand the evidence or to determine a fact in evidence,”<sup>43</sup> and be reliable.<sup>44, 45, 46</sup>

## **7.3.2 Procedural Issues**

As with most evidentiary issues, the trial judge has discretion in determining whether proffered expert opinion evidence is admissible.<sup>47</sup> This also typically includes discretion in identifying appropriate procedures to determine the admissibility of proffered expert opinion evidence.<sup>48</sup> The scope of that discretion, however, may turn on local law that is applicable in a given jurisdiction, which is beyond the scope of this Bench Book. In general, however, those procedural issues may include the following:

### *7.3.2.1 Is an Evidentiary Hearing Required To Determine Admissibility?*

Although a trial judge has the discretion to hold an evidentiary hearing before determining the admissibility of proffered expert evidence, in most situations, such a hearing is not required. What situations may require such a hearing, or strongly suggest that such a hearing be held, typically will be an issue of local law.<sup>49</sup> The need for such a hearing also is significantly diminished, if not eliminated, for

bench trials.<sup>50</sup> In addition, if proffered expert evidence is admitted by the trial judge and that expert testifies at trial, the trial transcript will provide a further record in scrutinizing whether the admissibility determination was proper. It should be remembered, however, that “[i]t is always within the trial court’s discretion to hold an evidentiary hearing to determine the reliability of proffered expert testimony.”<sup>51</sup>

### *7.3.2.2 What Findings Must the Trial Court Make In Ruling On Admissibility of Proffered Expert Evidence?*

Typically, a trial court is not required to make findings when ruling on the admissibility of evidence. This rule is less true for decisions on the admissibility of proffered expert evidence, where local law may require at least some findings.<sup>52</sup> The better practice is to make at least some findings setting forth the rationale used in deciding the admissibility of proffered expert evidence that is challenged, particularly if the evidence is precluded. This helps ensure that a proper record is made in resolving the issue (including whether an evidentiary hearing was requested or held); requires the trial judge to refine the analysis used in setting forth that rationale; and, provides a clearer record for the parties, counsel and others (including on appeal) for the rationale applied. Providing such rationale also avoids uncertainty for all, particularly on appeal:

*The better practice is to make at least some findings setting forth the rationale used in deciding the admissibility of proffered expert opinion evidence that is challenged, particularly if the trial judge decides to preclude the admission of the evidence.*

When trial courts fail to make an explicit record of their findings regarding the reliability of the proposed expert witness’s testimony, some appellate courts have exhibited a willingness to review the materials the trial court had before it to ascertain whether the trial court abused its discretion in admitting or excluding the testimony. Other appellate courts have extended their reviews to all of the materials in the trial record, including the testimony presented at the trial.

Such reviews by the appellate courts, of course, amount to their conducting their own reliability analyses. Trial courts, however, have a much broader “array of tools which can be brought to bear on the evaluation of expert testimony” than do appellate courts. There should be few cases “in which an appellate court should venture to superimpose a *Daubert* ruling on a cold, poorly developed record.”<sup>53</sup>

### 7.3.3 Specific Factors for The Trial Judge To Consider

In some respects, in determining admissibility of proffered expert evidence, there are as many specific factors for the trial judge to consider as there are cases that apply Rule 702. Even when not legally complicated, each case is factually rich and no two cases present the identical details or facts. The focus in all of this is admissibility, not correctness or weight, a distinction that can create confusion given the focus on reliability. With this preface, the following discussion highlights specific factors identified in 4 JACK B. WEINSTEIN & MARGARET A. BERGER, WEINSTEIN’S FEDERAL EVIDENCE CHAPTER § 702 (“Testimony by Expert Witnesses”) (2nd ed. 2018), perhaps the leading treatise in the area.

#### 7.3.3.1 Expert Qualifications (Including Helpfulness to The Trier of Fact).

Rule 702 requires that an expert have sufficient qualifications to testify, looking at the person’s “knowledge, skill, experience, training, or education” and requires that the proffered “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.”<sup>54</sup> “The standard for qualifying expert witnesses is liberal,” meaning a trial judge may abuse his or her discretion by excluding expert testimony “because the witness lacks a certain educational or other experiential background,” or where the witness “lacks expertise in specialized areas” when the witness has general educational and “experiential qualifications in a general field.”<sup>55</sup> Moreover, the qualification required by the rule are disjunctive, meaning “any one or more of these bases should be sufficient to qualify a witness as an expert.”<sup>56</sup>

The following factors may be relevant to whether the proffered expert’s qualifications will be helpful to the trier of fact:





1. Do the individual's qualifications relate to an issue the trier of fact will resolve?
2. Do the individual's qualifications turn on the person's "knowledge, skill, experience, training, or education," or some combination (and, depending upon which, is an adequate showing made of those qualifications)?
3. Does the relevant legal issue require an expert to have specific expertise (and, if so, does the proffered expert have such expertise)?
4. Does the relevant legal issue require an expert to have local expertise (and, if so, does the proffered expert have such expertise)?
5. Does the relevant legal issue require an expert to have expertise for a specific time period (and, if so, does the proffered expert have such expertise)?<sup>57</sup>

#### *7.3.3.2 Sufficient Facts or Data.*

Expert evidence must be "based on sufficient facts or data."<sup>58</sup> Although case-dependent, factors relevant to this inquiry include:

1. Is the proffered expert evidence "based on suppositions rather than facts?"
2. Is the proffered expert evidence a logical extension of research done independently of the litigation or is it developed solely for the purpose of the specific case?
3. Did the proffered expert rely "unduly on anecdotal evidence in arriving at an opinion?"<sup>59</sup>

#### *7.3.3.3 Reliable Principles and Methods.*

Expert evidence must be "the product of reliable principles and methods."<sup>60</sup> Factors relevant to this inquiry may include:

1. Can the theory or technique be tested and, if so, has it been tested?
2. Has the theory or technique “been published and subjected to peer review?”
3. What is the known or potential error rate in the application of the theory or technique?
4. Are there standards and controls for the application of the theory or technique (and, if so, has the proffered expert applied those standards and controls)?
5. Is the theory or technique generally accepted in the relevant scientific community?<sup>61</sup>

#### *7.3.3.4 Reliable Application of the Principles and Methods to the Facts.*

The final Rule 702 requirement is that the proffered expert “has reliably applied the principles and methods to the facts of the case.”<sup>62</sup> This inquiry requires the most from the trial judge, as it is only after the trial judge has some appreciation for the qualifications required, the facts and data necessary and the relevant principles and methods that the trial judge can determine whether those principles and methods have been reliably applied to the facts of the case. Factors relevant to this inquiry may include:

1. Does the proffered expert evidence represent an “unfounded extrapolation from the underlying data?”
2. Has the proffered expert “used a subjective methodology?”
3. Has the proffered expert properly connected the proposed expert evidence with the facts of the case?
4. Has the proffered expert adequately addressed alternative explanations?
5. Did the proffered expert rely “unduly on the temporal proximity between the occurrence of an event and the onset of illness or injury?”<sup>63</sup>



As noted in *Daubert*, “[t]he focus, of course, must be solely on principles and methodology, not on the conclusions they generate.”<sup>64</sup> In addition, for some narrow categories of expert evidence, it may be that the requirements of Rule 702(d) are not applicable.<sup>65</sup> Reference to local law is essential to determining whether a specific jurisdiction has recognized any exceptions to the Rule 702(d) requirements in such comparatively unique situations.

### *7.3.3.5 Is the Proffered Expert Evidence Otherwise Inadmissible?*

Even relevant proffered expert evidence otherwise admissible under Rule 702 may be excluded “if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.”<sup>66</sup> This standard for exclusion applies with full force to proffered expert evidence.<sup>67</sup> Similarly, expert evidence may be inadmissible for other reasons apart from Rule 403.<sup>68</sup>

*Even relevant proffered expert evidence otherwise admissible under Rule 702 may be excluded “if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.”*

# EXPERT EVIDENCE FLOWCHART

Federal Rules of Evidence (2018)



## 7.4 ADMISSIBILITY VS. WEIGHT

As with any evidence, the admissibility determination is separate from the weight to be given evidence that is admitted. Admissibility is for the court alone to decide, recognizing that determination dictates whether the finder of fact can even consider proffered evidence. As with fact evidence, even expert evidence that does not seem worthy of much weight may be admissible, with the finder of fact alone determining the weight it should be given. Moreover, the fact that competing experts disagree on analysis or conclusions does not mean one or the other is inadmissible.

Experts often disagree. A trial court's determination that the proffered testimony of one expert witness is reliable and helpful does not necessarily mean that the contradictory testimony of another witness, concerning the same subject matter but using different methodology, is not also reliable and helpful. This flows from two basic principles underlying the court's gatekeeping role.

First, the subject matter of expert testimony is almost never known to a certainty. Thus, expert witnesses need not be completely knowledgeable concerning their field of expertise and need not be totally convinced that their opinions are correct to be qualified to testify to those opinions. Second, the court's limited objective is to assess whether the proffered evidence is admissible because it is sufficiently reliable to be helpful to the trier of fact. The court is not determining whether the proffered evidence is actually correct; this latter question is reserved for the trier of fact.<sup>69</sup>

When amending Rule 702 in light of the *Daubert* Trilogy, the Committee Notes on Rules to the 2000 Amendments observed that, when a trial court “rules that an expert’s testimony is reliable, this does not necessarily mean that contradictory expert testimony is unreliable. The amendment is broad enough to permit testimony that is the product of competing principles or methods in the same field of expertise .... As the court stated in *In re Paoli R.R. Yard PCB Litigation*, 35 F.3d 717, 744 (3d Cir. 1994), proponents “do not have to demonstrate to the judge by a preponderance of the evidence that the assessments of their experts are correct, they only have



to demonstrate by a preponderance of evidence that their opinions are reliable . . . . The evidentiary requirement of reliability is lower than the merits standard of correctness.”

As a final example, comments by one state supreme court in adopting Rule 702 as that state’s standard merit repeating.

The amendment recognizes that trial courts should serve as gatekeepers in assuring that proposed expert testimony is reliable and thus helpful to the jury’s determination of facts at issue. The amendment is not intended to supplant traditional jury determinations of credibility and the weight to be afforded otherwise admissible testimony, nor is the amendment intended to permit a challenge to the testimony of every expert, preclude the testimony of experience-based experts, or prohibit testimony based on competing methodologies within a field of expertise. The trial court’s gatekeeping function is not intended to replace the adversary system. Cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.

A trial court’s ruling finding an expert’s testimony reliable does not necessarily mean that contradictory expert testimony is not reliable. The amendment is broad enough to permit testimony that is the product of competing principles or methods in the same field of expertise. Where there is contradictory, but reliable, expert testimony, it is the province of the jury to determine the weight and credibility of the testimony.<sup>70</sup>



## 7.5 ENDNOTES

1. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923)
2. *Id.*, 293 F. at 1014
3. *Id.*
4. *Id.*
5. *Id.*
6. *Id.*
7. *Frye*, 293 F. at 1014
8. *Id.*
9. Dr. Marston, whose name is not mentioned in the *Frye* opinion, later became a comic book writer and the creator of Wonder Woman. JILL LEPORE, *THE SECRET HISTORY OF WONDER WOMAN* at 73 (2015).
10. *Id.*
11. *See generally*, Eileen A. Scallen, *Analyzing the Politics of (Evidence) Rulemaking*, 53 HASTINGS L.J. 843 (2002). (citing authority and noting, given the lack of the Federal Rules of Evidence, the promulgation of the Model Code of Evidence in 1942 by the American Law Institute and the Uniform Rules of Evidence promulgated in 1953 by the National Conference of Commissioners on Uniform State Laws (often called the Uniform Law Commission).)
12. Fed. R. Evid. 702 (1975).
13. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 586 (1993).
14. *Daubert*, 509 U.S. at 582.
15. *Daubert*, 509 U.S. at 583.
16. *Daubert*, 509 U.S. at 587.
17. *Id.*
18. *Daubert*, 509 U.S. at 588.
19. *Daubert*, 509 U.S. at 589.

20. *Daubert*, 509 U.S. at 589, 590.
21. *Daubert*, 509 U.S. at 591-592.
22. *Daubert*, 509 at 592-93 (footnotes omitted).
23. *Daubert*, 509 U.S. at 593.
24. *Daubert*, 509 U.S. at 593, 594.
25. *Daubert*, 509 U.S. at 594 (citation omitted).
26. *Id.*
27. *Id.*
28. *Daubert*, 509 U.S. at 594-95.
29. “The court may exclude relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.” Federal Rules of Evidence, (2018).
30. *Daubert*, 509 U.S. at 595.
31. *Daubert*, 509 at 596 (footnotes omitted).
32. *Id.*
33. *Daubert*, 509 U.S. at 597.
34. General Elec. Co. v. Joiner, 522 U.S. 136, 138-39 (1997).
35. Kumho Tire Co. v. Carmichael, 526 U.S. 137, 141 (1999).
36. Fed. R. Evid. 702 (2018).
37. The corresponding flow chart addresses these same issues, in the same order, recognizing that relevance under Rule 401 and helpfulness to the trier of fact to understand the evidence or determine a fact in issue under Rule 702(a) often have substantial overlap.
38. See, e.g., Ariz. R. Evid. 701 (“Opinion Testimony by Lay Witnesses”); 703 (“Bases of an Expert’s Opinion Testimony”); 704 (“Opinion on Ultimate Issue”). See also Fed.R.Evid. 702 (“Testimony of Expert Witness,” providing an expert may “testify in the form of an opinion or otherwise.”)



39. Fed. R. Evid. 702.
40. Fed. R. Evid. 701.
41. Fed. R. Evid. 401.
42. Fed. R. Evid. 402.
43. Fed. R. Evid. 702(a).
44. Fed. R. Evid. 702(d); *See also Daubert*, 509 U.S. at 589 (“the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable”)
45. *Daubert*, 509 U.S. at 591 (noting the requirement that evidence assist the trier of fact “goes primarily to relevance”);
46. *Daubert*, 509 U.S. at 594-95 (noting Rule 702 inquiry is “a flexible one. Its overarching subject is the scientific validity—and thus the evidentiary relevance and reliability—of the principles that underlie a proposed submission”).
47. *See Kumho Tire Co.*, 526 U.S. at 152.
48. *Id.*
49. 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.02[6][b] at 702-29 to 7-35 (2nd ed. 2013) (citing cases).
50. *Id.* at § 702.02[6][b] at 702-29 to 702-30 (2nd ed. 2013) (“When the gatekeeper and the trier of fact are the same, the court may admit evidence subject to the ability to exclude it or disregard it, if the evidence turns out not to meet the standard of reliability under Rule 702.”).
51. *Id.* at § 702.02[6][b] at 702-29 (2nd ed. 2013) (footnote omitted).
52. *See Glazer v. Arizona*, 234 Ariz. 305, 315-16 (Ariz. Ct. App. 2014) (“The federal circuits are split on whether such findings are required. *Compare* *United States v. Mitchell*, 365 F.3d 215, 233-34 (3d. Cir. 2004) (reviewing merits of ruling on admissibility of expert evidence ‘adher[ing] to the usual precepts of abuse-of-discretion review,’ where the trial court ‘elected not to make findings of fact or conclusions of law (written or oral)’) and *Conwood Co. v. U.S. Tobacco Co.*, 290 F.3d 768, 791-95 (6th Cir. 2002) (similar) with *United States v. Roach*, 582 F.3d 1192, 1207 (10th Cir. 2009) (noting trial court ‘is required to make specific, on-the-record findings that the testimony is reliable under *Daubert*’); *see also* *Mukhtar v. Cal. State Univ., Hayward*, 319 F.3d 1073, 1076-77 (9th Cir. 2003) (Reinhardt, J.,


- dissenting from denial of rehearing en banc) (discussing various approaches).”),  
*vacated in part on other grounds*, 237 Ariz. 160 (Ariz. 2015).
53. Fed. R. Evid. 702(a).
  54. 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.02[7] at 702-37 (2nd ed. 2013) (citations omitted).
  55. *Id.* at § 702.04[1][a] at 702-57-59 (2d ed. 2013) (footnotes and citations omitted).
  56. *Id.* at § 702.04[1][c] at 702-64 (2d ed. 2013) (footnote and citations omitted).
  57. *Id.* at § 702.04[1][c] at 702-61-87 (2d ed. 2013) (footnote and citations omitted).
  58. Fed. R. Evid. 702(b).
  59. 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.04[2][b] at 702-102-104 (2d ed. 2013) (footnote and citations omitted).
  60. Fed. R. Evid. 702(c).
  61. Although set forth in a somewhat different form, this list is closely paraphrased from factors identified in 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.04[2][c] at 702-105-113 (2d ed. 2013) (footnote and citations omitted).
  62. Fed. R. Evid. 702(c).
  63. Although set forth in a somewhat different form, this list is closely paraphrased from factors identified in 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.04[2][d] at 702-116-118.8 (2d ed. 2013) (footnote and citations omitted).
  64. *Daubert*, 509 U.S. at 595
  65. *See generally* Arizona v. Salazar-Mercado, 234 Ariz. 590, 325 Ariz. 996 (Ariz. 2014) (in case addressing admissibility of evidence of Child Sexual Abuse Accommodation Syndrome, holding state-law version of Rule 702(d) did not “bar admission of ‘cold’ expert testimony that educates the fact-finder about general principles without considering the particular facts of the case.”)
  66. Fed. R. Evid. 403.
  67. *See Daubert*, 509 U.S. at 595 (cautioning trial judges, in assessing expert evidence, to “be mindful of other applicable rules,” including Fed. R. Evid. 403).
  68. 4 WEINSTEIN’S FEDERAL EVIDENCE § 702.03 at 702-52-56 (2nd ed. 2013) (providing various examples of when proffered expert opinion evidence is inadmissible, including “if it does no more than tell the trier of fact what conclusion



to reach;” contract interpretation; witness credibility; state of mind; the law the jury should apply; and legal conclusions).

69. *Id.* at § 702.05[3] at 702-118.8 (2d ed. 2013) (footnote and citations omitted).
70. Ariz. R. Evid. 702, cmt. to 2012 Amendment

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An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops. Scattered throughout the background are small, light-colored numbers (0-9) in a random distribution.

# 8. JUVENILE COURT

Sections 8.1 - 8.4

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**HON. CINDY LEDERMAN (RET.)**

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## 8.1 THE USE OF SCIENCE IN JUVENILE COURT

### 8.1.1 Introduction

The Family Court judge's legal mandate is to promote the safety and well-being of children which can best be achieved by healing relationships and families. It is not a traditional judicial role, and it requires a non-traditional approach. Science must be the center of our judicial repertoire. Without the use of scientific evidence and techniques, a Juvenile Court Judge cannot begin the healing process or, provide effective services or even begin to understand the needs of children and their families.

Unfortunately, many decision-makers in family and juvenile law remain largely unaware of decades of research regarding child development and effective psychosocial interventions applicable to various populations.<sup>2</sup> Judges and child development researchers rarely intersect, and therefore the opportunity to learn from the other is almost nonexistent.<sup>3</sup> That chasm between our practice and our knowledge of research is particularly unfortunate, and sometimes, harmful because we don't understand how our decisions effect the child. The law in this area is old but much of the scientific research is new. We now know that child maltreatment literally changes the brain of a young child.

*Judges are holding the integrity of a child's brain in their hands.*

*Dr. Jack Shonkoff,  
Director, Center for the  
Developing Child, Harvard*

What the family court really does is clinical work in a legal setting working with the most disadvantaged population of families who often appeared in a courtroom in circumstances too late for effective intervention. Judges whose legal education did not include how to teach a mother to smile, talk, and

read to her baby; to pick her baby up when she cries; to praise, sit on the floor and play with her; and, not shake her, must learn how to do these things in order to be effective in Juvenile Court. Although these acts seem straightforward for any parent, they are new and novel to many of the parents we see.

Although judges have limited time, in Juvenile Court they need to be students of child development research as much as they are students of relevant appellate decisions



involving procedure, evidence, and substantive law. Judges need to understand the characteristics of the people they are trying to help, including their risk factors, protective factors and level of functioning. Judges need to understand the history of the families they see in order to understand how to help them. Judges need to know about their behavior, the traumas they have suffered, and especially their resilience.

Removing children from their home because a court has determined that it is not safe for them to be there, exposes them to another type of harm—the emotional and developmental trauma that come from custodial separation.<sup>4</sup> This is particularly true for infants.<sup>5</sup> Children have difficulty coping with separation from their primary caregivers. Depending upon their ages and emotional maturity the damage can be devastating.<sup>6</sup> For an infant or toddler the longer the separation, the greater the risk of harm.<sup>7</sup> Therefore, it is important for juvenile court judges to be aware of child development and attachment theory.

*The law in this area is old but much of the scientific research is new.*

Judges should understand and appreciate the fundamental need for healthy attachments between parent and child. Research in early childhood development has revealed that babies can be depressed, that they have long-term memory of trauma, and that they are significantly affected by just the mood and affect of their caretaker, who may often be depressed or emotionally unavailable when the child is in the child welfare system.<sup>8</sup> As a result, once a parent has been diagnosed with depression, the court may need to order services to address that depression so that it does not continue to adversely impact the child and the opportunity for reunification.

### 8.1.2 The Science of Nonverbal Cues in Infants

The use of the science of child development to better understand the reactions of maltreated infants and toddlers can be an important tool for judges. Fifteen percent of the children ordered into foster care are less than a year old.<sup>9</sup> Those placed within three months of their birth stay in care nearly twice as long as older children.<sup>10</sup> Learning how these infants communicate with nonverbal cues is something a juvenile court judge can understand and learn.



*Judges fail to order infant mental health evaluations because they incorrectly assume they cannot be done until a child is verbal.*

The truth is that young children are very communicative even before they can talk. They have different cries for different needs; their eyes light up when they are happy; their play can communicate a lot about them and their families; and, their willingness to be held by a stranger tells us about the strength of their attachment to their primary caretaker.<sup>11</sup> These nonverbal cues play an integral part of the all-important attachment relationship.<sup>12</sup>

### 8.1.3 Understanding Attachment Theory

Starting about two months after birth, infants begin to show an attachment preference for certain caregivers.<sup>13</sup> About the fourth month, this preference is communicated through cues in the presence of that caregiver.<sup>14</sup> These cues, which express the child's emotional response, intensifies as the child ages.<sup>15</sup> They will begin protesting when separated from the key person and will also send rejection cues when reunited.<sup>16</sup>

Beginning around the age of three, children begin to generalize attachment however these attachment behaviors last throughout a child's development process, but are simply less visible.<sup>17</sup>

The attachment process must be reciprocal.<sup>18</sup> Infants who cannot depend upon their caregiver often form harmful attachments.<sup>19</sup> An infant might display cues seeking closeness until the caregiver responds and then immediately send rejecting cues.<sup>20</sup> The vast majority of maltreated infants (up to 82%) develop warped attachments patterns.<sup>21</sup> These babies also are likely to develop high levels of stress hormones which, impacts their developing brain causing long-term harm.<sup>22</sup> Finally these infants are at higher risk for delinquency, substance abuse, and depression.<sup>23</sup>

A judge's understanding of attachment theory helps when making decisions about visitation and foster care. A healthy attachment between an infant and the primary caregivers is necessary for social, emotional, and cognitive development providing the bedrock for personal self-reliance, and positive coping as they grow to adulthood.<sup>24</sup>



### 8.1.4 The “Still Face” Effect<sup>25</sup>

One of the most poignant and revealing translational research tools used to convince judges that even babies are affected by the momentary affect of their caregiver is revealed in the excellent DVD “Helping Babies From the Bench.”<sup>26</sup> It highlights an experiment known as “the still face.” In the experiment, infants were videotaped with their mother in the face-to-face “still-face” paradigm developed by Tronick, Als, Adamson, Wise, and Brazelton.<sup>27</sup> The paradigm involves a two-minute face-to-face play interaction with the mother, a two-minute still-face session during which the mother looks at the child but is unresponsive, followed by another two-minute session involving play interaction between mother and infant.<sup>28</sup>

The experiment has been used extensively to evaluate young infants’ communicative abilities, sensitivity to changes in maternal behavior, ability to cope with interpersonal disturbances and capacity to regulate affective states.<sup>29</sup> During the still-face phase, mothers are asked to look at their infants but not to touch, smile, or talk to them.<sup>30</sup> The mothers’ face, position, and eye contact signal the infants that social interaction is forthcoming, while their expressionless face and lack of response communicate the opposite.<sup>31</sup> The mothers remain expressionless even after the infants try to reinstate the interaction. The video shows the baby avert her gaze, pull at her clothing, point, and scream to try to make her mother to respond to her, and she becomes extremely distressed and deteriorates as her mother, present but non-responsive, fails to meet the her expectations.<sup>32</sup>

*Young brains are resilient. They can heal from early maltreatment with the right services.*

The behavior, which is foreign in a healthy mother-child relationship, puzzles and disturbs the child who is otherwise accustomed to having her needs met.<sup>33</sup>

Use of information from tests based upon the still face effect provide information about a caregiver’s responsiveness and can help with an infant’s “attachment classification at age 1, internalizing (e.g., depression, anxiety) and externalizing (e.g., aggression, impulsivity) behaviors at 18 months, and behavior problems at age 3.”<sup>34</sup> The effect is also useful when dealing with “cross-cultural differences, deaf infants, infants with Down syndrome,

cocaine-exposed infants, ...children with autism, and children of parents with various psychopathologies, especially depression.”<sup>35</sup>

### 8.1.5 Informed Decision-making

The applied results of child development and related research, allow judges to change the way they do their work. For example, judges can learn when, how, and why they must intervene when they learn that a child is fussy during a visit with a parent or otherwise demonstrates that she does not want to visit a parent. Judges should try to help the parent appreciate how much their behavior impacts the child. If the parent wants visits with the child to go well, the parent needs to change her behavior for the child’s health and well-being. This can enhance the court’s effort to create family reunification.

Our juvenile courts should adopt the philosophy of Dr. Selma Fraiberg, an infant mental health pioneer, who recognized the unique possibilities of this work when she said working with very young children is “a little like having God on your side.”<sup>36</sup> We now understand that maltreated children have significant disproportionate developmental delays, and that it is the responsibility of the court to do what we can to search for these delays and help these young children.<sup>37</sup> Child development research helps us make better decisions about the type and frequency of visitation because one size does not fit all. Judges should work hard to carefully choose the first placement for babies and toddlers, and use concurrent planning to assure, whenever possible, that the first placement can be the final placement if reunification fails.

Judges should also use science when making custody decisions. As Professor Elizabeth Bartholet queries, should we continue to romanticize heritage, or should we really examine the capacity to parent first and foremost?<sup>38</sup>

Judges don’t automatically determine custody by having the child spend half of the week with each parent. While an easy judicial decision, it is rarely in the best interest of the child who requires routine and stability. The use of existing evidence-based programs that are known to be effective, like home visitation, Early Head Start, and Head Start, must be part of a judge’s toolbox. The judiciary must use programs for our families based upon empirical evidence of effectiveness.



### 8.1.6 The Necessity for Evidence Based Interventions in Child Welfare

How do we know the programs we send parents and children to work? Do we investigate outcome studies on different treatment modalities? What type of program is best for what type of individuals? These should be the first questions we ask before we order our families into programs as required in their case plans. Does the treatment for Substance Use Disorders work? Does the domestic violence program decrease violent behavior? Are parenting classes appropriate and useful? Are parents learning and changing their behavior? How do we know what works?

Judges must realize what every researcher knows -- some interventions “work,” some have no effect (the null hypothesis) and some actually harm (have iatrogenic effects) the people they were designed to help.

*Judges have the responsibility to ask questions and demand that the services we order for children and families are well designed, well monitored, and well evaluated.*

The job of judging, especially in juvenile court, is complex and difficult, but judges have the responsibility to ask questions and demand that the services we order for children and families are well designed, well monitored, and well evaluated to determine whether they are beneficial.

Judges must use parenting intervention services that are evidence-based. An order for parents to attend didactic “parenting classes,” even though many are inadequate and non-evidence-based, is ineffective and a waste of the parent’s money.<sup>39</sup> In many jurisdictions, there is no research-based structured curriculum, little monitoring and training, and no interactive component for the parent to practice with their child the new skills they have learned in the presence of the parenting teacher to exhibit their level of understanding.<sup>40</sup> Other than attendance, the classes do not have structured requirements to measure successful completion.<sup>41</sup> There are no systematic assessments of progress, no observations of parent and child interactions, and no qualitative and quantitative measures to determine if insight has been gained and new practices and beliefs integrated.<sup>42</sup>



We can no longer send all of our parents to a parenting program with no evidence of effectiveness and where compliance is measured by attendance only. This is a failure to make “reasonable efforts.”<sup>43</sup> And what about families who need more intensive, individualized, longer term services? What is needed when a parenting program is not enough to change the parent’s behavior?

One science-based therapy that addresses inter-generational transmission of child maltreatment uses infant-parent psychotherapy.<sup>44</sup> Infant-parent psychotherapy is an individual, intensive clinical intervention developed by Dr. Alicia Lieberman and modified by Dr. Joy Osofsky for use in the dependency court.<sup>45</sup> The dyadic intervention focuses on the relationship between parent and baby in an effort to help the parent gain insight about how the “ghosts in the nursery” interfere with the parent being able to care adequately for her baby.<sup>46</sup> The infant mental health therapist promotes empathy and models appropriate parenting skills for the parent.<sup>47</sup>

Infant-parent psychotherapy is based on the following concepts:<sup>48</sup>

- The infant has been harmed in the relationship and must be “healed” in that relationship.
- The therapeutic work incorporates a broad range of techniques to enhance the mother’s awareness and responsiveness to her child’s needs.
- Emotional and behavioral problems in infancy and early childhood need to be addressed in the context of primary attachment relationships.
- Promoting growth in the caregiver-child relationship supports healthy development of the child long after the intervention ends.

Research has shown that such intensive evaluation and relationship-based treatment can impact positively on the interactions between very high-risk parents and children and their developing relationship. Findings include:<sup>49</sup>

- Important improvements in both parental sensitivity to the children and in the children’s emotional responsiveness and behaviors.





- No further abuse or neglect
- 86% reunification rate and 100% permanency placement

Juvenile court judges are some of the most caring and competent people in America. They have begun to understand that their ability to make decisions based on what they think or feel can only be enhanced if they also consider what the research and science tells us.

## 8.2 CORE CONCEPTS OF HUMAN DEVELOPMENT

A healthy attachment to another human being and the feeling of security and safety it provides is an essential key to a positive development. One of the most critical tasks of infancy is developing that healthy attachment.<sup>50</sup> Unfortunately, children in our court system often lack this crucial foundation. What is particularly unfortunate is the fact that early relationships form the basis for all later relationships, so the Court must make restoring or creating a healthy attachment for every child a priority.<sup>51</sup>

1. Human development is shaped by a dynamic and continuous interaction between biology and experience.
2. Culture influences every aspect of human development and is reflected in childrearing beliefs and practices designed to promote healthy adaptation.
3. The growth of self-regulation is a cornerstone of early childhood development that cuts across all domains of behavior.
4. Children are active participants in their own development, reflecting the intrinsic human drive to explore and master one's environment.
5. Human relationships, and the effects of relationships on all relationships, are the building blocks of healthy development.
6. The broad range of individual differences among young children often makes it difficult to distinguish normal variations and maturational delays from transient disorders and persistent impairments.
7. The development of children unfolds along individual pathways whose trajectories are characterized by continuities and discontinuities, as well as by a series of significant transitions.

*Restoring or creating a healthy attachment for every child is a priority. It is the essential key to a positive development.*



8. Human development is shaped by the ongoing interplay among sources of vulnerability and sources of resilience.
9. The timing of early experiences can matter, but, more often than not, the developing child remains vulnerable to risks and open to protective influences throughout the early years of life and into adulthood.
10. The course of development can be altered in early childhood by effective interventions that change the balance between risk and protection, thereby shifting the odds in favor of more adaptive outcomes.<sup>52</sup>

**Some things judges can do:**

1. Convene a multidisciplinary team to oversee the services each child needs.
2. Frequently monitor the child's development and progress toward a permanent family.
3. For the children who need foster placement, make the first placement the last.
4. Order frequent visits between very young children in foster care and their parents.
5. Visits (when in the child's best interest) offer the best possible opportunity to begin to heal a damaged relationship.<sup>53</sup>

### 8.3 VALUABLE RESOURCES

Among the decades of research now available, an indispensable tool for judges is *From Neurons to Neighborhoods: The Science of Early Childhood Development*, published in 2000, by the National Academy of Sciences (NAS). It was published after an expert committee was convened by NAS to summarize the science of early childhood development. It should be on the bench next to this bench book, rules of evidence, and other tomes.

One of the finest websites providing and translating the science of child development was created by Dr. Jack Shonkoff at Harvard's Center on the Developing Child and can be found at: [www.developingchild.harvard.edu](http://www.developingchild.harvard.edu).

Another book, written by a judge, an early childhood expert and a psychologist working together in a dependency court, *Child Centered Practices for the Courtroom and Community: A Guide to Working Effectively with Young Children and their Families in the Child Welfare System*<sup>54</sup> is a practical guide to navigating the complex child welfare system and exalting the needs and services for children and families.

Another essential tool is translational research that explains the results for the practitioner. One of the finest examples of this is a DVD created by the Miami Child Well-being Court and Zero to Three, the National Center on Infants, Toddlers and Families, entitled "Helping Babies from the Bench: Using the Science of Early Childhood Development in Court."<sup>55</sup> It is a 20-minute visual lesson in the science of child development and the possibilities for reform in a research informed court and community environment is a wise investment.

The California Evidence-Based Clearinghouse for Child Welfare<sup>56</sup> is an excellent resource where researchers and policymakers might find reviews and ratings of relevant programs evaluated on child welfare populations.

## 8.4 ENDNOTES

1. The terms “Juvenile” and “Family” are used interchangeably in this section since different states have different vocabularies. The cases covered in this section have to do with “dependency” – child abuse and neglect cases and the quest for family reunification.
2. E.J. Maher, et. al., *Overcoming challenges to implementing and evaluating evidence-based interventions in child welfare: A matter of necessity*. 31 CHILDREN & YOUTH SERVICES REVIEW, SERVS REV. 555 (2009)..
3. J. Kelly & M. Lamb, *Using Child Development Research to Make Appropriate Custody and Access Decisions for Young Children*, 38 FAM. & CONCILIATION CTS. REV. 297 (2000).
4. Am. Acad. Pediatrics Com. on Early Childhood, Adoption & Dependent Care, *Developmental Issues for Young Children in Foster Care*, 106 PEDIATRICS 1145 (2000).
5. *Id.*
6. *Id.*
7. *Id.*
8. ZERO TO THREE, CRITICAL COMPETENCIES FOR INFANT-TODDLER EDUCATORS, <https://www.theounce.org/wp-content/uploads/2017/04/ZTTCriticalCompetenciesforInfant-ToddlerEducatorsinBrief2015.pdf> (last visited April 14, 2019)
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10. F. Wulczyn & K. Hislop, *Babies in Foster Care: The Numbers Call for Attention*, 22 Zero To Three J. (2002). See also S. Dicker, et. al., *Improving the Odds for the Healthy Development of Young Children in Foster Care*. (Nat’l Center for Children in Poverty, Mailman Sch. Pub. Health, Column. U., (2002).
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14. Disengagement cues signal the infant's need for a break or rest from interacting with the caregiver. Some of these cues include: Crying or fussing, turning head and/or body away from caregiver, squirming or kicking, back arching or pulling away, coughing, choking, spitting up or vomiting, and falling asleep.
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An abstract graphic featuring a teal wireframe mesh that forms a series of overlapping, flowing loops. Scattered throughout the background are small, light-colored numbers (0-9) in a random distribution.

# 9. THE EXPERT WITNESS

Sections 9.1 - 9.8

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**CHRISTINE FUNK, ESQ.**

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## 9.1 FOUNDATION FOR EXPERT WITNESS TESTIMONY

*Daubert* and *Frye* are discussed at length in Section 7 of this Bench Book and will not be rehearsed here. The trial court has broad discretion to determine whether an expert's testimony will be admitted in whole or in part. The National Academy of Sciences' Report, *Strengthening Forensic Science, A Path Forward*, has been somewhat critical of Federal appellate courts, noting they "have not with any consistency or clarity, imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving *Daubert* questions."<sup>1</sup> Of course, given the flexibility of the *Daubert* standard, this is not particularly surprising.

Of note, however, in the vast majority of reported criminal cases, trial judges rarely excluded or restricted expert testimony offered by the government. Additionally, most reported opinions show appellate courts deny appeals where the issue is whether the trial court wrongly decided to admit forensic evidence against criminal defendants. Conversely, in civil cases, appellate courts are more likely to second guess a trial court's judgment regarding the admissibility of "purported scientific evidence."<sup>2</sup>

### 9.1.1 Inclusion or Exclusion: A Judgment Call

Courts may, in their gatekeeper function, choose to exclude expert testimony based on the rules governing their jurisdiction. In *Daubert* states (see Appendix 1), as well as in federal court, the judge has considerable flexibility. For example, a court may choose to exclude an expert on the issue of shaken baby syndrome because the theory or technique in question cannot be tested. Alternatively, the court may decide studies done using monkeys is an acceptable method for testing the theory. A court may decide to exclude evidence because the expert cannot provide a known error rate. Alternatively, the court may decide they are not concerned with the lack of an established error rate.





### 9.1.2 Limiting Testimony: Another Alternative

Judges may also consider limiting the testimony of an expert witness. For example, in reviewing the proposed testimony of a firearms' examiner, a judge found "no meaningful distinction between a firearms examiner saying that 'the likelihood of another firearm having fired these cartridges is so remote as to be considered a practical impossibility' and saying that his identification is 'an absolute certainty'."<sup>3</sup> Holding neither opinion justified or warranted, the judge recommended limiting the testimony of the expert to stating opinions and the bases for the opinions without any characterization regarding the degree to which the expert was certain.

In 2016, the Attorney General for the United States, Loretta Lynch, issued a Memorandum for Heads of Department Components instructing every federal forensic laboratory to review and, if necessary, amend their policies and procedures regarding expert testimony. The mandate required federal laboratories "ensure that forensic examiners are not using the expressions 'reasonable scientific certainty' or 'reasonable [forensic discipline] certainty' in their reports or their testimony."<sup>4</sup> Further, the mandate instructed department prosecutors refrain from using those expressions when questioning forensic experts in court or presenting forensic reports unless they were required to do so by a judge or by law.<sup>5</sup>

While the use of the term "reasonable degree of scientific certainty" is commonly used in cases involving experts, its use is not mandated by the federal courts or most state courts. Further, this statement has no scientific meaning, nor is this standard employed in scientific disciplines. Science is never certain. There is always room for error.

Problems with the use of the terms "scientific certainty" or "discipline certainty" include:

- The absence of a common definition for the term, both across scientific disciplines and within scientific disciplines
- The "use of the term 'scientific' cloaks the opinion with the rigor, acceptance and reproducibility of scientific study"

- When paired with the word “reasonable” there is a risk the jury may equate the certainty with which the expert offers their opinion with the certainty required by the “beyond a reasonable doubt” standard of proof in criminal cases.
- When coupled with probabilistic testimony, the issue becomes even more confusing, as the juror must evaluate the “reasonable degree of certainty” against a statistic or other probabilistic estimate.<sup>6</sup>

### 9.1.3 General Rules of Admissibility

While different jurisdictions will have slightly different rules of admissibility, generally speaking an expert’s testimony is admissible if:

- The knowledge of the expert will assist the trier of fact to either come to a determination about a fact in issue or understand the evidence in the case and
- The testimony offered is based on “sufficient facts or data”
- The opinions or conclusions are based on principles and methods considered reliable in the scientific community
- The reliable principles and methods were applied reliably in the case at bar.<sup>7</sup>

Other rules of evidence may also come into play when determining whether an expert witness should be allowed to testify. This may include situations where the expert’s proposed testimony is not particularly relevant, or where the evidence, while relevant, carries the risk of unfair prejudice, confusing the issues, misleading the jury, causing undue delay or a waste of time, or is needlessly cumulative.<sup>8</sup>



## 9.2 THE ETHICS, DUTIES AND RESPONSIBILITIES OF EXPERT WITNESSES

Of course, we would all like to think that expert witnesses have a code of ethics they abide by. However, there is not a single organization that governs ethics for expert witnesses. Instead, there are various organizations that have ethical standards – some with more teeth than others.

For example, the National Association of Medical Examiners (NAME) has a Code of Ethics and Conduct. Their Code has five prongs:

- No member shall exercise professional or personal conduct which is adverse to the best interests and purposes of the Association or the profession
- No member shall materially misrepresent their educational training, experience, area of expertise, certification, membership status within NAME or their official title or position
- All shall refrain from providing material misrepresentations of data upon which an expert opinion or conclusion is based
- With the exception of certain members in positions of authority, no member shall issue public statements which appear to represent the positions of name
- NAME members must affirm their understanding and endorsement of the Code each time their membership is up for renewal.<sup>9</sup>

Similarly, the American Society of Crime Lab Directors offers a code of ethics, which states, in part, “No member of ASCLD. . .

- Shall engage in conduct harmful to the profession of forensic science, including, but not limited to:
  - Any proven illegal activity
  - Any documented technical misrepresentation

- Any documented distortion
- Any scholarly falsification as pertaining to membership requirements in ASCLD or their employment
- Shall misrepresent their expertise or credentials
- Knowingly fail to address or attempt to cover up
  - any misrepresentation and/or falsification of analytical work or
  - testimonial presentation or
  - the improper handling of evidentiary material by an employee of their laboratory
- knowingly fail to notify customer(s), through proper laboratory management channels, of
  - material nonconformities or
  - breaches of law or professional standards that adversely affect a previously issued report or testimony from their laboratory.<sup>10</sup>

However, this code of ethics is for crime lab directors, not the forensic scientists themselves. Some professional organizations, such as the American Academy of Forensic Sciences (AAFS)<sup>11</sup> and the American Board of Criminalistics (ABC)<sup>12</sup> offer codes of ethics; however, membership in these organizations is not mandatory for scientists. Often, scientists must pay for their own membership, rather than the crime lab paying for membership. While the ABC requires applicants sit for an exam demonstrating their competence, the same is not true of the AAFS. This is not a criticism of AAFS. Rather, it is simply a recognition that different organizations have differing purposes, and while membership in each has its privileges, not all forensic organizations are the same.

### 9.2.1 Progress Towards a National Standard of Ethics

In 2010, the Education, Ethics, and Terminology Inter-Agency Working Group (EETIWG) of the National Science and Technology Council's Subcommittee on Forensic Science developed a National Code of Ethics and Professional

Responsibility for Forensic Sciences (NCEPRFS). While the EETIWG recommended that all practitioners who offer reports and/or expert opinion testimony regarding forensic evidence in the United States adopt the code, this recommendation was not acted upon.

In 2016, the National Commission on Forensic Science recommended the adoption of a code of ethics which built on the NCEPRFS. Attorney General Lynch did so for all Department of Justice forensic examiners.<sup>13</sup> The Code includes 15 mandates for forensic science practitioners, and one for lab managers. While this Code was written for forensic scientists, it provides a general framework designed to apply to experts in all disciplines.

### 9.2.2 Ethical Violations

In recent years, there have been some prominent news articles addressing unethical conduct engaged in by experts. Generally speaking, most unethical conduct falls into one of the following categories:

- Failing to investigate
- Failing to consider all relevant data
- Taking on assignments beyond the expert's ability or competence
- Arriving at conclusions before doing the work
- Falsified data
- Falsified credentials
- Altered data
- False testimony
- Conflicts of interest<sup>14</sup>

Unfortunately, there are a considerable number of examples of unethical conduct in cases involving science. One of the earliest examples involves Scientist Fred Zain, who worked in West Virginia from 1979 to 1989. As a forensic scientist, Zain testified in the murder trial of Glen Dale Woodall about blood and hair evidence.



Originally convicted and sentenced to two life terms without parole, advances in forensic science led to additional testing which exonerated Mr. Woodall. The state of West Virginia settled the subsequent wrongful imprisonment lawsuit for a million dollars after investigating the work of Fred Zain.<sup>15</sup>

An internal audit, a grand jury investigation, and a subsequent legislative probe of Zain's work revealed misconduct including:

- Overstating the strengths of test results
- Overstating and misstating the frequency of statistics associated with genetic evidence
- Falsely reporting testing was performed
- Reporting inconclusive test results as conclusive
- Altering laboratory records
- Deliberately misrepresenting test results
- Failing to report conflicting results
- Implying a match with a suspect when the evidence matched the victim and
- Reporting results that were scientifically impossible.<sup>16</sup>

The state of Massachusetts recently dismissed thousands of drug cases due to the deliberate actions of chemist Annie Dookhan. Ms. Dookhan pled guilty to perjury and evidence tampering, as well as obstruction of justice for her conduct as a forensic scientist in the William A. Hinton State Laboratory Institute in Boston. She tampered with evidence by deliberately introducing drugs into evidentiary samples to ensure a positive test result, forged test results, and misrepresented her qualifications in court.<sup>17</sup>

These are just two of countless examples of ethical breaches by scientists.



### 9.3 THE INDEPENDENCE AND IMPARTIALITY OF EXPERTS

#### GENERAL PRINCIPLES

In theory, experts are independent and impartial. They are given data pertaining to their area of expertise and asked to opine as to its meaning or significance, or to offer an interpretation. The expert's evaluation stems from their knowledge, which may be scientific or technical in nature, or it may be based on some other specialized knowledge. Experts answer questions such as:

- What happens when a car with balding tires drives around a bend at 10 miles over the posted speed limit in the rain?
- Can an error in coding create a security risk for a website?
- Is a parent unfit to retain custody of their children?

To answer these and other questions directed towards experts, they must have sufficient facts or data, which is used to apply their methods. The methods or principles applied must be reliable and, depending on the state rules, sometimes must be generally accepted in the relevant scientific or technical community.

When an expert has a scientific, technical, or otherwise specialized foundation of knowledge, experience, skill, training, or education, and they have reviewed the relevant data, they draw their conclusions or opinions.

When attorneys hire experts, both the attorney and the expert should be clear on this guiding principle: experts are paid for their knowledge, experience, skill, training, or education, not for a given opinion. Experts and attorneys should both be clear on the fact that no particular outcome can be guaranteed prior to reviewing the relevant data.

## 9.4 STATING FACTS OR ASSUMPTIONS, AND CONSIDERING ALL MATERIAL FACTS

In any case involving expert testimony, the conclusions presented will rely in part on facts, and in part on assumptions. Some, but not all, disagreement between experts can be attributed to two differences: a difference in the facts supplied by the attorneys, and a difference in the assumptions made by the expert. Assumptions should be supported by relevant facts.

The Federal Rules of Civil Procedure require experts disclose certain information within their report. Specifically, the Rules require reports include, among other things:

- A complete statement of all opinions of the expert, and the basis and reasons for the opinions
- The facts or the data the witness relied upon when forming their conclusions
- Disclosure of any exhibits the expert will use to either summarize or support their findings.<sup>18</sup>

Similarly, the Canadian Institute of Chartered Business Valuators (CICBV) require experts include in their reports the assumptions they relied on, as well as the procedures they followed to determine the appropriateness and reasonableness of their assumptions. Experts are required to classify their assumptions as follows:

- Assumptions the expert is directed to take, that are not within his/her area of expertise;
- Those assumptions made by the Expert, within his/her area of expertise and based on scope of work executed by him/her; and
- Those assumptions that the Expert is directed to take on matters that are within his/her area of expertise, but where the Expert was not provided opportunity to execute a scope of work appropriate to add assurance to the assumption.<sup>19</sup>

By differentiating between facts relied upon and assumptions made, the expert clarifies what they are basing their opinion on. This can help the attorneys as well as the trier of fact. It provides a clearer comparison between the conclusions of different experts.

One of the challenges attorneys face is their lack of understanding of what is, or may be, “material facts” conflicting with their limited expert budget. Experts typically charge by the hour, and while an attorney may have the luxury of providing every bit of data for their expert to review, often, attorneys must make judgment calls about what they will and won’t provide an expert. An experienced attorney will preface their disclosures with a discussion with the expert. While the Federal Rules of Criminal Procedure do not require experts detail the facts or data upon which their conclusions are based,<sup>20</sup> it is none the less good practice for the experts to do so.

## 9.5 RED FLAGS: LACK OF OBJECTIVITY / IMPARTIALITY

The role of an expert witness is to first, examine the evidence and draw conclusions about the evidence. When testifying, the role of the expert is to convey these conclusions or opinions to the trier of fact. Their role is *not* to simply attempt to counter the other side's expert, or to "win" the case. Nonetheless, sometimes in their belief in the "rightness" of their conclusions, they lose track of their objective role as experts.

While there have been rare cases where an expert's lack of objectivity resulted in the exclusion of the testimony, in many instances, the apparent lack of objectivity has been found to go to weight, not admissibility. The lawyers are left to expose the prejudices to the fact finder.

One clue which may indicate a lack of objectivity or impartiality may be indicated by who the expert works for regularly. If an expert only testifies for one side, this may be an indication of bias. However, there are several circumstances which could lead to such "one sided" testimony. For example, a person who works for the state-run crime lab may routinely testify for the prosecution. This makes a certain amount of sense, as most often, a forensic crime laboratory's evidence will support the prosecution's theory. Similarly, a chemist who performs studies on the cancer-causing potential of certain pesticides on animals may never be called to testify by a pesticide manufacturer.

*Judges may have to decide whether an expert's lack of objectivity calls for exclusion of testimony or only goes to the weight the trier of fact should give it.*

One way courts can explore potential bias is by considering, for example, the crime laboratory's policy regarding meeting with and answering questions from defense attorneys.

- Does the crime lab willingly meet with attorneys from either side?





- Does the crime lab report visits from defense counsel to the prosecution, but not report prosecution visits to the defense?
- Are there different policies for meeting with prosecution and defense attorneys?
- Is the crime lab funded by the prosecution or a law enforcement agency?

Treating all participants in a criminal case equally shows a measure of independence, regardless of who is footing the bill for the work. On the other hand, a crime lab that only cooperates with one side may lack impartiality.

The Federal Rules of Civil Procedure require disclosure of some information that may provide the court with insight about a given witness. Expert witnesses must disclose:

- The qualifications of the witness, including a list of all publications the witness has authored in the past 10 years
- A list of cases where the witness testified as an expert by deposition or at trial within the past four years and
- Information on who the expert is compensated for the review of the case, as well as their testimony.<sup>21</sup>

This information may provide the court with some information about an expert's fundamental approach to the science in question. While there are experts who routinely testify for both sides of an issue, many experts are regularly relied on only by one side or the other. This is not to say that if someone only testifies for plaintiffs, for example, in personal injury cases that they are not objective. This is merely a starting point.

Overstating the strength of one's opinion or going beyond the scope of the supported science are both red flags which should alert the court of the possibility of a lack of impartiality. Examples include:

- A forensic DNA expert testifying a male DNA profile found on an adult woman's intimate swabs proves a rape occurred
- A firearms expert testifying the absence of gunshot residue proves one did not fire a weapon
- An arson expert testifying the evidence the fire was intentionally set proves the accused set the fire
- A parenting expert testifying mothers are always the better choice as the custodial parent.

There are certain recognized forms of bias which can influence a person, whether they are a lawyer, judge, or scientist. Confirmation bias, for example, recognizes our tendency to identify with information that confirms what we already believe, while ignoring information inconsistent with our beliefs. Anchoring bias refers to a human's tendency to place more than appropriate levels of reliance on the first piece of information acquired. Observer expectation bias refers to the tendency to believe data that agrees with their expected outcomes, while disbelieving or downplaying corresponding data that conflicts with their expectations.<sup>22</sup>



## 9.6 KNOWLEDGE OUTSIDE WITNESS'S EXPERTISE

Witnesses should know the limits of their expertise. They should also feel comfortable drawing the line clearly and have the freedom to refuse to answer a question beyond their knowledge. Unfortunately, this does not always happen. Some experts are more than willing to opine on information beyond their expertise. When a judge, as gatekeeper, has determined an expert is qualified to testify about one topic, and the expert, on their own or at the prompting of the attorney, ventures into another area, what is the court to do? To a certain extent, this judgment call may be dictated by a judge's own philosophy. Some judges may feel compelled to jump in and stop a witness or seek clarification as to the intention of the attorneys or the knowledge of the witness. Other judges are content to remain silent unless or until someone voices an objection.

There is a very real risk of an attorney asking the expert a question outside their area of expertise. Examples of this include:

- Asking a crime scene tech how frequently a gun yields a usable forensic DNA profile
- Allowing a forensic biologist to testify to blood spatter patterns
- Permitting an arson expert to offer an opinion about whether the autopsy photos of the lungs indicate the presence of smoke

Attorneys and judges alike would do well to familiarize themselves with the witness' curriculum vitae, which should clearly document where a witness does, or does not, have the requisite expertise to testify about a certain issue. In a case where there is doubt about whether or not a witness has the requisite expertise, providing the witness the opportunity to point out where, on their CV, they have established the knowledge, skill, experience, training, or education can bring clarity to the issue.

## 9.7 FIVE THINGS JUDGES SHOULD KNOW ABOUT EXPERTS

1. Experts may not actually be experts, but rather people who claim expertise, coupled with lawyers who don't challenge the basis for their claims.
2. Experts may be willing to testify beyond their area of expertise.
3. Laboratory accreditation is not a commentary on a scientist's individual competence.
4. Membership in scientific organizations may or may not mean anything beyond the ability to pay for membership.
5. Most experts sincerely believe their evaluation of the evidence. Their level of confidence in their results, however, is not correlated with the likelihood that they are right.



## 9.8 ENDNOTES

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20. Fed. R. Crim. P. 16
21. Fed. R. Civ. P. 26 (a) (2) (B) (iv – vi)
22. Teo Choong Ching, Types of Cognitive Biases You Need to Be Aware of as a Researcher, (September 27, 2016). <https://uxdesign.cc/cognitive-biases-you-need-to-be-familiar-with-as-a-researcher-c482c9ee1d49>





# 10. EVIDENCE-BASED SENTENCING

Sections 10.1 - 10.4

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**HON. KEVIN S. BURKE**

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## 10.1 INTRODUCTION

When sentencing a defendant, what sort of evidence should a judge look for? Surely it is not evidence based upon erroneous assumptions or flawed implicit bias. But sentencing *is* part judgment—driven by experience. There is a human component of compassion when imposing a sentence. Current best sentencing evidence is not perfect evidence—but the best there is. The best evidence for sentencing is not old or out-of-date evidence; but modern, up-to-date evidence.

How is evidence-based sentencing going to help judges make the right decisions? In a conscientious, explicit, and judicious way.

- **Conscientious**—being careful, and thorough, in what you do;
- **Explicit**—being “up-front,” open, clear and transparent;
- **Judicious**—using good judgement and common sense.

Evidence-based sentencing is driven by actuarial tools, which can be the best current evidence to assist a judge in sentencing. The term *judicious* implies the actuarial tools are an aid to a judge’s judgment, not a substitute for it. In Professor Marc Miller’s article, *A Map of Sentencing and a Compass for Judges: Sentencing Information Systems, Transparency, and the Next Generation of Reform*,<sup>1</sup> he identifies five areas that have motivated the sentencing reform movement (1) Bringing law to the sentencing arena to replace highly discretionary systems; (2) addressing sentencing disparities for similarly situated defendants; (3) reliance upon different justifications for punishment and the collapse of the rehabilitation focus for punishment; (4) desire for greater control over resource use; and (5) the quest for the implementation of rational and proportionate rules and penalties that limit reliance on inappropriate factors.

The goal of evidence-based sentencing is to address the issues Professor Miller outlined and to more effectively:

- identify who may be safely and effectively supervised in the community; and,



## 10. EVIDENCE-BASED SENTENCING

- order appropriate conditions of community supervision given the defendant's recidivism risk, criminogenic needs, and responsiveness factors.

There is institutional support for evidence-based sentencing. In 2007, the Conference of Chief Justices (CCJ) adopted a resolution entitled “In Support of Sentencing Practices that Promote Public Safety and Reduce Recidivism.”<sup>2</sup> The Resolution emphasized that the judiciary “has a vital role to play in ensuring that criminal justice systems work effectively and efficiently to protect the public by reducing recidivism and holding offenders accountable.”<sup>3</sup> The CCJ committed to “support state efforts to adopt sentencing and corrections policies and programs based on the best research evidence of practices shown to be effective in reducing recidivism.”<sup>4</sup>

Similarly, the American Bar Association (ABA) has urged states to adopt risk assessment tools in an effort to reduce recidivism and increase public safety.<sup>5</sup> The ABA emphasized concerns relating to the incarceration of low-risk individuals, cautioning that the placement of low-risk defendants with medium and high-risk defendants may increase rather than decrease their risk of recidivism.<sup>6</sup> Such exposure can lead to negative influences from higher risk defendants and actually be detrimental to the individual's efforts at rehabilitation.<sup>7</sup>



## 10.2 WHAT DOES EVIDENCE-BASED SENTENCING INVOLVE?

### 10.2.1 Conducting validated risk, needs, and responsiveness assessments of the defendant

Evidence-based sentencing focuses on predicting a defendant's recidivism risk based on empirical research.<sup>8</sup> Evidence-based sentencing is a type of risk assessment, or actuarial analysis, that relies on a large dataset to evaluate the “statistical correlations between a group trait and that group’s criminal offending rate” as opposed to a clinical evaluation.<sup>9</sup> Recidivism, for example, can be predicted based upon a wide range of factors, including criminal history, sex,<sup>10</sup> age, marital status, employment, education, parental convictions, whether family members who have been crime victims, school grades, and chances of finding work above the minimum wage. The set of assessments typically includes an actuarial assessment of general recidivism risk, and other specific risks (e.g., violence or sexual offending); a structured assessment of the defendant’s criminogenic needs; and additional assessments to identify factors that may pose challenges to the effective treatment of the defendant. It sounds simple, but it isn’t: assessment instruments must be properly validated for use with the jurisdiction’s target population of defendants.

### 10.2.2 Risk/Needs Assessment

Judges make “clinical judgments” when they sentence. But there are limitations on a judge’s “best clinical judgment.” At sentencing, how does a judge determine if the defendant is telling the judge the truth? Determining credibility is among the most difficult tasks a trial judge has. Judges are not necessarily better than others at figuring out who is telling the truth. For example, in a controlled study of 110 judges with an average of 11.5 years on the bench, judges did not do better than chance in telling who was being truthful and who was not.<sup>11</sup>

Judge Learned Hand once said, “The spirit of liberty is the spirit which is not too sure that it is right.”<sup>12</sup> So if determining who is telling the truth is problematic, what about determining the sincerity of remorse? Professor Eve Hanan’s research looked at the following: Whether a defendant expresses remorse at criminal sentencing



often has a direct bearing on the severity of the sentence. But how good are judges at accurately assessing genuine, meaningful remorse?<sup>13</sup>

Research demonstrates that many judges have flawed “clinical judgment” about remorse. Remorse can include any verbal or nonverbal expression of regret for committing a crime. It conveys acceptance of personal responsibility. A male defendant’s face, for example, might show no remorse because his view of masculinity requires him to refrain from emotional displays.<sup>14</sup>

There are actuarial risk assessment instruments shown to be more accurate than a judge’s clinical judgment in determining offender risk. But that does not mean that evidence-based sentencing is the sole basis upon which a judge should approach sentencing, and clinical judgment should never be employed. The “Tyranny of the ‘or’” is a flawed approach to decision making that assumes there is only a solitary choice between one of two seemingly contradictory strategies or outcomes. Adherence to evidence-based sentencing and the analysis tools it brings does not require a judge to discard clinical judgment. Rather than the tyranny of the “or,” analytic tools and sound clinical judgment by a judge produces the genius of the “and.” Understanding the use of risk and needs assessment information is therefore critical in making evidence-based sentencing decisions, such as:

- Most appropriate conditions of probation to be imposed;
- Defendant's amenability to treatment;
- Most appropriate treatment or level of supervision to be imposed; and
- Kind of sanction, incentive or additional service to be ordered upon a violation of probation.

The Indiana Supreme Court in *Malenchik v. State of Indiana* observed that “the concept of evidence-based sentencing practices has considerable promise for the goal of reduced offender recidivism and improvement of sentencing outcomes.”<sup>15</sup>

In *State of Wisconsin v. Eric L. Loomis*, the Supreme Court of Wisconsin held that the use of risk assessment tool at sentencing did not violate the defendant’s due process right to be sentenced based on accurate information or his due process right

to an individualized sentence. The risk assessment tool's consideration of his gender did not violate his due process rights.<sup>16</sup>

Wisconsin charged Eric Loomis with five criminal counts related to a drive-by shooting. Loomis denied participating in the shooting, but he admitted that he had driven the same car involved later that evening. Loomis pleaded guilty to two of the less severe charges. In preparation for sentencing, a Wisconsin Department of Corrections officer produced a Presentence Investigation Report (PSI) that included a Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) risk assessment.<sup>17</sup> COMPAS is a “risk–need assessment system . . . that incorporates a range of theoretically relevant criminogenic factors and key factors emerging from meta-analytic studies of recidivism.”<sup>18</sup>

The Wisconsin Supreme Court's decision in *Loomis* rejected Loomis's challenges and cautioned trial judges not to abandon their clinical judgments. The methodology behind COMPAS is a trade secret, and only the estimates of recidivism risk are reported to the court. Courts would do well when negotiating the purchase of an evidence-based system, to include in the contract a clause that ideally permits a court, with appropriate safeguards, to know what is behind the methodology.

### 10.2.3 Provide assessment results to the court

In many jurisdictions that employ evidence-based sentencing, assessment results are included in the presentence investigation report. However, in lieu of a traditional PSI, some jurisdictions elect to develop an alternate and more succinct assessment report.

The jargon of evidence-based sentencing focuses on “criminogenic needs,” meaning characteristics, traits, problems, or issues of a defendant that directly relate to the defendant's likelihood to re-offend. Criminogenic needs fall into two categories: static and dynamic. The underlying theory is that offending is a product of the history of criminal justice involvement and specific criminogenic needs. By attending to dynamic criminogenic needs through proper treatment and control programming, one can affect offending behavior.



Those that cannot be changed are labeled “static.” Examples include prior record or family criminality. For example, early onset of criminal behavior is a very good predictor of future behavior. Those factors that can be changed are labeled “dynamic.” They may include factors like who a defendant hangs around with, defendants’ attitudes and values, their lack of problem solving skills, their substance use, and their employment status. All these are correlated with recidivism, and all can be targeted for change. These dynamic factors are also called *criminogenic needs*, crime producing factors that are strongly correlated with risk.<sup>19</sup>

The assessment report should provide information about the defendant’s overall level of risk and criminogenic and other needs. What are criminogenic needs and why are they important? Four major risk factors are associated with criminal conduct: antisocial/procriminal attitudes, values, and beliefs; procriminal associates; temperament and personality factors; and, low levels of educational, vocational, or financial achievement.

To ensure that the assessment information provided to the court is based on a validated instrument and has not been overridden by an agency without notice to the court and counsel, the report should also indicate whether the assessment result(s) had been subject to an agency override.

### 10.2.4 Use assessment results to inform sentencing decisions about community supervision, treatment, and other services for the offender

In deciding the appropriate sentence for the defendant, judges should consider information pertinent to several different sentencing goals. A judge may decide that sentencing goals such as punishment or restitution are most important in a case. Evidence-based sentencing typically applies only to sentencing decisions in which the judge seeks to address the goal of public safety through offender risk reduction and management.

To make evidence-based sentencing decisions, the judge will consider:

- The defendant’s individual risk level, dynamic needs, and responsivity factors<sup>20</sup>

- The supervision and monitoring options available
- The sanctioning options available
- The treatment services designed to address criminogenic factors (needs) that are available

In some jurisdictions, the judge will make decisions about the conditions of supervision designed to ensure effective recidivism risk management if the defendant is placed in the community. In other jurisdictions probation officers make that decision.

Most evidence-based sentencing tools use information that has been central to sentencing schemes for many years such as a defendant's criminal history. An increasing amount of jurisdictions use static factors such as gender, age, marital status, education level, employment history, and other demographic information to determine risk and inform sentencing.

This practice has drawn sharp criticism from Attorney General Eric Holder. He says "using static factors from a criminal's background could perpetuate racial bias in a system that already delivers 20% longer sentences for young black men than for other offenders."<sup>21</sup> He has said that "utilizing such tools for determining prison sentences to be served will have a disparate and adverse impact on offenders from poor communities already struggling with social ills."<sup>22</sup>



### 10.3 DOES *DAUBERT* (OR *FRYE*) APPLY TO EVIDENCED-BASED SENTENCING?

Sentencing hearings do not subject scientific evidence to the same rigorous testing as during trial, but the prongs of *Daubert* analysis may be helpful in assessing the analytical tools that a court wishing to employ evidence-based sentencing might apply.

**Prong 1:** Whether evidence-based sentencing tool has been tested and validated to your jurisdiction

**Prong 2:** Whether evidence-based sentencing tool has been subjected to peer review or publication

**Prong 3:** What Is the known (or potential) error rate and are there standards that control evidence-based sentencing?

While the criminal justice system has experienced real progress in its ability to create and use reliable sentencing assessments, some of these instruments have shown a tendency towards disparate impacts. Thus, using the *Daubert* prongs will help ensure that an evidence-based approach to sentencing is fair and balanced.



## 10.4 ENDNOTES

- 1 Marc L. Miller, *A Map of Sentencing and a Compass for Judges: Sentencing Information Systems, Transparency, and the Next Generation*, 105 COLUM. L. REV. 1351 (2005).
- 2 CONFERENCE OF CHIEF JUSTICES, CONFERENCE OF STATE COURT ADMINISTRATORS, NAT'L CENTER FOR ST. CTS, RESOLUTION 12: IN SUPPORT OF SENTENCING PRACTICES THAT PROMOTE PUBLIC SAFETY AND REDUCE RECIDIVISM (August 1, 2007), <http://ncsc.contentdm.oclc.org/cdm/1fref/collection/ctcomm/id/139>.
- 3 *Id.*
- 4 *Id.*
- 5 Am. Bar Ass'n, Crim. Just. Section, *State Policy Implementation Project*, 18, [http://www.americanbar.org/content/dam/aba/administrative/criminal\\_justice/spip\\_handouts.authcheckdam.pdf](http://www.americanbar.org/content/dam/aba/administrative/criminal_justice/spip_handouts.authcheckdam.pdf).
- 6 *Id.* at 19.
- 7 *Id.*
- 8 See PA. COMM'N ON SENT'G, OVERVIEW OF THE RISK ASSESSMENT INSTRUMENT, <http://pcs.la.psu.edu/publications-and-research/research-and-evaluation-reports/risk-assessment> [<https://perma.cc/5FUC-GVX2>].
- 9 Bernard Harcourt, *Against Prediction: Sentencing, Policing, and Punish-Series*, Paper No. 94, 2005); see J. Hyatt, et al., *Follow the Evidence: Integrate Risk Assessment into Sentencing*, 23 FED. SENT'G REP. 266, 266 (2011) [hereinafter *Follow the Evidence*] (noting that actuarial risk assessments rely on static variables whereas clinical risk assessments rely on dynamic variables).
- 10 Factors like sex can raise constitutional issues. See Shaina D. Massie, Note, *Orange Is the New Equal Protection Violation: How Evidence-Based Sentencing Harms Male Offenders*, 24 WM. & MARY BILL RTS. J. 521, 522 (2015) ("Penological considerations of gender in sentencing are simply incompatible with abstract notions that criminal offenders appear before the court in their individual capacities. More important, the use of gender in evidence-based sentencing violates the concrete promises of equal protection under the law provided by the Constitution.").
- 11 See P. Ekman & Ma. O'Sullivan, *Who Can Catch a Liar?*, 46 AM. PSYCHOLOGIST 913 (1991); R. Schauffler & K. Burke, *Who Are You Going to Believe?*, 49 CT. REV. 124 (2013).



## 10. EVIDENCE-BASED SENTENCING

- 12 Learned Hand, *The Spirit of Liberty*, Address at “I Am an American Day” in New York City’s Central Park (May 21, 1944), in *The Spirit of Liberty: Papers and Addresses of Learned Hand* 189, 189 (Irving Dilliard ed., 3d. ed. 1986).
- 13 Eve Hanan, *Remorse Bias*, 83 Mo. L. Rev. 301 (2017). [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3079788](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3079788).
- 14 N. Dowd et al., *Feminist Legal Theory Meets Masculinities Theory*, in *MASCULINITIES AND THE LAW: A MULTIDIMENSIONAL APPROACH* 25, 31 (Frank R. Cooper & Ann C. McGinley eds., 2012).
- 15 *Malenchick v. State*, 928 N.E.2d 563, 569 (Ind. 2010).
- 16 For a contrary position, *see* footnote 10.
- 17 Tim Brennan, et al., Northpointe Inst. for Pub. Mgmt. Inc., *Evaluating the Predictive Validity of the COMPAS Risk and Needs Assessment System*, 36 CRIM. JUST. & BEHAV. 21 (2009).
- 18 *Id.*
- 19 Edward Latessa, *What are Criminogenic Needs and Why are they Important?*, FOR THE RECORD, 4th Quarter 2005.
- 20 Responsivity principle: Maximize the offender’s ability to learn from a rehabilitative intervention by providing cognitive behavioural treatment and tailoring the intervention to the learning style, motivation, abilities and strengths of the offender.
- 21 Daniel Luis, *The Dangers of Evidence-Based Sentencing*, GOVLAB BLOG 2014 <http://thegovlab.org/the-dangers-of-evidence-based-sentencing/>
- 22 *Id.*

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An abstract graphic featuring teal wireframe lines that form a series of overlapping, flowing loops. Scattered throughout the background are small, light-colored numbers (0-9).

# 11. POST SENTENCING SUPERVISION

Sections 11.1 - 11.11

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**HON. BRIAN MacKENZIE (RET.)**

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## 11.1 INTRODUCTION

In the last 50 years, courts in the United States have increasingly used emerging technology to assist in supervising those who have been sentenced to probation.<sup>1</sup> These technologies include new forms of alcohol and other drug testing, computer information systems, remote reporting, and global positioning systems. Recent studies have found that these scientific and technical approaches can reduce recidivism and reduce supervision costs.<sup>2</sup>

There is, however, persuasive evidence that many judges are employing these tools without understanding precisely how they work.<sup>3</sup> In order for judges to make effective use of these new tools they must understand these technologies to produce results that are scientifically valid and forensically defensible. This section will highlight these tools and discuss the strengths and weaknesses of their use.





### 11.2 ELECTRONIC TRACKING DEVICES

There are two major types of electronic tracking devices: Radio Frequency Monitoring (RFM)<sup>4</sup> and Global Positioning Satellite (GPS).<sup>5</sup>

RFM devices are primarily used in home confinement and for curfew enforcement.<sup>6</sup> A tracking bracelet is attached to an individual and a base receiver is in their home.<sup>7</sup> Many, RFM receivers require a landline telephone in order to contact a base computer.<sup>8</sup>

The receiver then locates the bracelet and a distance parameter of about 100 feet is set.<sup>9</sup> If the individual moves beyond the parameters, within the set time limitations, an alert will be sent to a computer in the supervising company or agency.<sup>10</sup> These receivers also use technology that prevents an offender from moving or disabling them.<sup>11</sup>

*There are pluses and minuses for RFM and GPS.*

RFMs are equipped with a battery back-up systems that can maintain the unit's operation if electrical service is interrupted allowing them to store data during a power outage that can be retrieved at a later time.<sup>12</sup>

GPS, the second type of tracking system, begins with the use of 24 satellites currently circling the planet.<sup>13</sup> These satellites orbit at an altitude of approximately twelve thousand miles so that they circle the earth twice each day.<sup>14</sup> They are spaced in six equal orbital groupings, ensuring at least four satellites are always over every part of the globe.<sup>15</sup>

GPS can track an individual's movements by triangulating a bracelet transmitter signal to three of these satellites, while the fourth measures the time between the signals of the other three.<sup>16</sup> The measurement that is provided by the four satellites can place an individual's position, speed, time and location within 72 feet.<sup>17</sup>

The GPS bracelet transmitter is usually worn on an individual's ankle and should have a built-in, tamper-resistant component to prevent interfering with or the removal of the transmitter.<sup>18</sup> The rechargeable batteries inside the unit should last a minimum of a year before needing replacement. The charging unit for the

transmitter is placed in the offender's home and works as a link to update the software for the bracelet.<sup>19</sup>

Like an RFM, GPS can be used to enforce a home confinement order where a defendant is ordered confined to their residence as opposed to being incarcerated.<sup>20</sup> GPS home confinement is created by a zone that excludes everything more than 150 feet from the recharging station.<sup>21</sup> An exclusion zone is a geographic area or set

*There are an unlimited number of inclusive or exclusive "zones" that may be created for the defendant.*

of areas where the offender is not permitted to go.<sup>22</sup>

An inclusion zone is a geographic area or set of areas where an offender is allowed to be.<sup>23</sup> The use of these zones, however, is not limited to home confinement.<sup>24</sup>

Depending upon the type of crime the individual has committed, an exclusion zone may include a spouse or former partner's home or place of employment in the case of domestic assault.<sup>25</sup> It may also be used to exclude parks, schools or places that sell alcoholic beverages depending upon the crime for which the individual was convicted and which type of supervision is necessary.<sup>26</sup> An inclusion zone may include the offender's office, work or treatment location.<sup>27</sup> In designing an order it is important to know that there is no limit to the number of zones that can be created.<sup>28</sup>

The zones are developed with mapping software that is quite simple to use.<sup>29</sup> A probation officer or other member of the court staff can enter the address, city, or state into the main computer<sup>30</sup> and the GPS receiver records the zone's parameter.<sup>31</sup> The positioning system also has the technology to provide the exact location of the probationer in the event the staff decides to dispatch police in an emergency.<sup>32</sup>

As seen in Chart 11.1, active GPS has been used in a broad array of cases:<sup>33</sup>

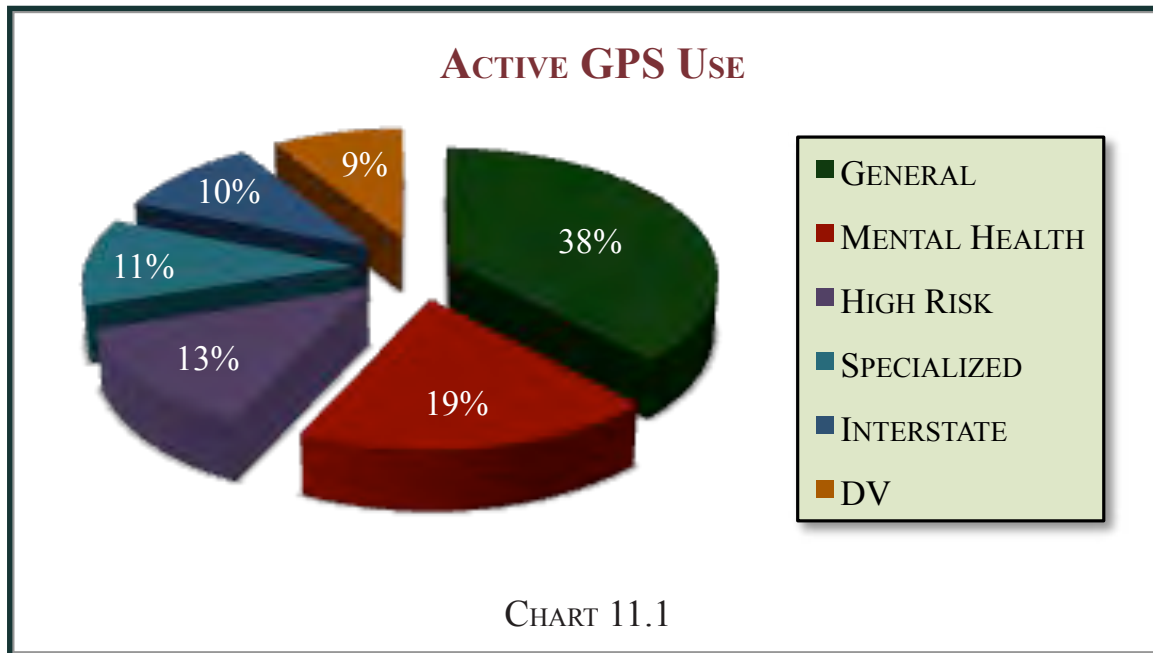
- 38 percent of the offenders were on general supervision;
- 19 percent were on mental health supervision;
- 13 percent were on specialized supervision for high-risk substance use;<sup>34</sup>



## 11. POST SENTENCING SUPERVISION

- 11 percent were on sex offender supervision;
- 10 percent were on interstate supervision; and
- 9 percent were on domestic violence supervision.

All electronic monitoring systems can send zone violation notifications to probationary staff and, if ordered by the court, other parties such as witnesses and victims.<sup>35</sup>



A Pew Research Center survey found a recent decline in the use of RFM.<sup>36</sup> Its use by courts fell twenty-five percent between 2005 and 2015.<sup>37</sup> However, the use of GPS technology more than made up for the RFM decline with a thirtyfold increase from a decade earlier.<sup>38</sup> (See Figure 11.2.) The change in usage suggests that RFM cannot compete with the more flexible GPS systems. This should be a factor courts consider when making decisions about the technology they select.

In 2006, a Florida study of 75,661 offenders ordered to use RFM and GPS found these tracking devices had “prohibitive” effect on absconding.<sup>39</sup> The analysis

established that individuals placed on these tracking devices were 89 to 95% less likely to be arrested for a new offense while wearing the bracelet.<sup>40</sup> The authors concluded:

In relation to public safety effectiveness, electronic monitoring was found effective in reducing the likelihood of reoffending and absconding while on home confinement. Both radio frequency and GPS significantly reduced the likelihood of revocation for a new offense and absconding from supervision, even when controlling for sociodemographic [Generally, **characteristics** such as age, gender, ethnicity, education level, income, type of client, years of experience, location, etc. are being considered as **socio-demographics** and are being asked in all kinds of surveys] characteristics of the offender, current offense prior record, and term of supervision factors and conditions. The authors also concluded both types of devices were equally effective at reducing revocations or incidents of absconding.<sup>41</sup>

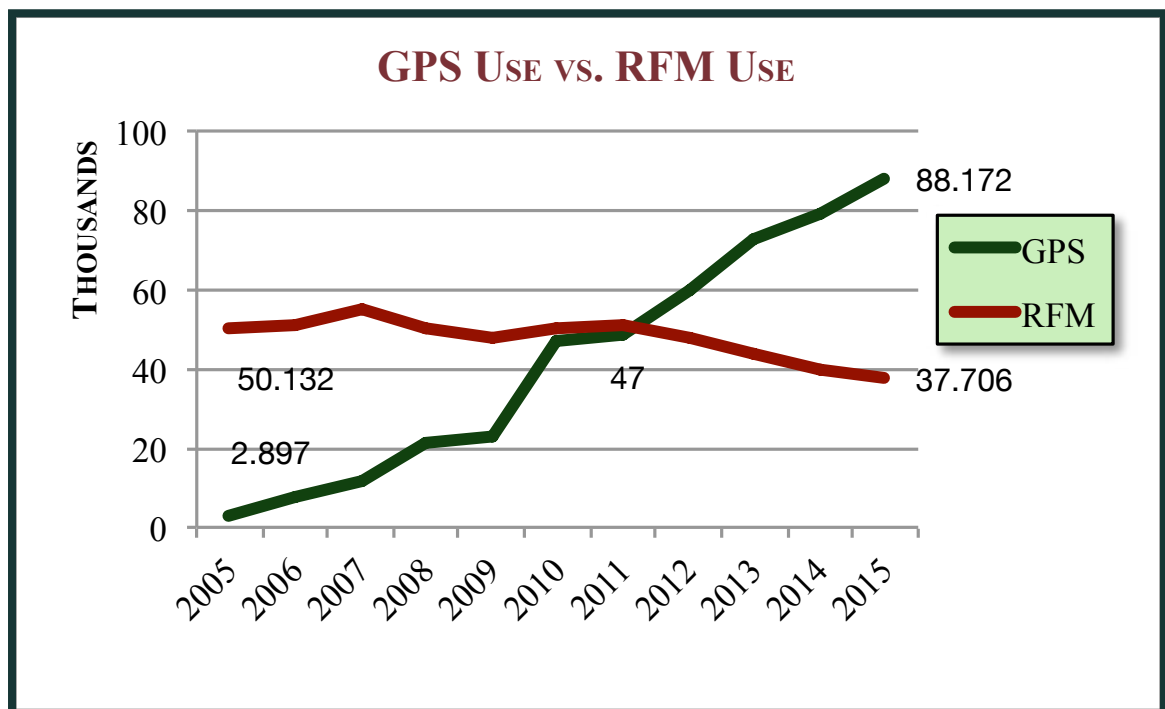


CHART 11.2

### 11.3 DIGITAL MONITORING

Digital monitoring relies on software to track a probationer's use of a computer, tablet and/or smartphone.<sup>42</sup> There are two basic types of software (both direct and remote) that are used to monitor an individual's internet use.

Direct digital supervision relies on a type of software that can be used by a probation officer who is not trained in computer forensics.<sup>43</sup> The first version of this software was developed to track sex offenders by the National Law Enforcement and Correctional Technology Center in 2005 and has been routinely updated.<sup>44</sup> It is available, without cost, to any criminal justice agency.<sup>45</sup> To install the software, court staff must have direct access to the probationer's device(s).<sup>46</sup> Once installed it searches the device's browsing history, cookies, images, social media, and text files.<sup>47</sup> It can also be set to search for keywords and images.<sup>48</sup> The software will automatically log all files that have been opened and provide a date and time stamp for their original use.<sup>49</sup>

The results are downloaded onto a standard spreadsheet for review and analysis.<sup>50</sup> This allows a probation officer to understand the individual's internet use including their downloading habits.<sup>51</sup>

Remote digital monitoring relies on software that can be installed on a probationer's device at any time and, once installed, continuously monitors the computer's usage.<sup>52</sup> The information is then wirelessly transmitted to the probation staff for review.<sup>53</sup> As with direct monitoring, the information is downloaded onto spreadsheets for review. There are some limitations on the use of remote monitoring as current software cannot access email or chat information.<sup>54</sup>

*Digital monitoring may be used to track a probationer's computer, tablet and smartphone usage including downloaded images.*

A recent issue paper by the American Probation and Parole Association provides a detailed comparison of the two forms of digital monitoring.<sup>55</sup> (See Table 11.1.)



## COMPARISON OF DIRECT AND REMOTE SOFTWARE

Direct	Remote
Can detect evidence months, even years, old.	Only monitors from time software is installed. Will not open and search files/directories. Will record whatever the user does on the monitored system after installed.
Can be used to examine all operating systems and any device with memory, including all computers, cell phones, I-Pods, MP3 Players, gaming devices, GPS devices, cameras, printers, USB drives, memory sticks, etc.	Monitoring software is primarily limited to Windows and Apple operating systems and computers. Hardware devices can be used for other operating systems. Some cell phones can be monitored. However, there is no monitoring software or hardware for gaming devices, I-Pods, cameras, and other devices.
Wiping utilities can destroy evidence. Encryption programs can prevent evidence from being reviewed. Steganography can conceal evidence all together. These programs can therefore reduce a search's effectiveness. A search might detect the presence or use of these programs and can be used to determine if monitoring software has been defeated. Additionally, searches can be used to examine computers which were used in lieu of a monitored computer.	Monitoring software records everything that occurs, including using wiping, encryption and/or steganography [file concealing] programs. Results can also be forwarded to a remote location, out of offender's control. The results can be reviewed showing the evidence as well as attempts to conceal or destroy it. Disabling monitoring software itself can occur. However, getting it back up and running, without detection, is usually problematic. Best way to overcome monitoring is simply to use a non-monitored computer.



## COMPARISON OF DIRECT AND REMOTE SOFTWARE

Direct	Remote
Depending upon extent of search and software may take up to an hour, days or even weeks.	Software installation is fast, usually done in less than half hour. Time spent reviewing monitoring results is dependent upon number of alerts received and user activity. Average estimated review time varies from few minutes to several hours. The reviews, dependent upon software, might need to occur on site vs. in the office.
Traditionally searches required direct access to computer. However, there is some forensic software that allows a remote search of a system. An officer installs software on the system that allows an officer to view what is on an offender's system at any time through the Internet.	Software can either maintain results on the target computer, which requires direct access or can forward results to an officer or to a server for review over the Internet.
Dependent upon when search is done. If search not done for days noncompliance will not be detected for days.	Software that reports via the Internet can generate alerts and/or monitoring reports which can be reviewed almost in real time. Software that does not communicate via the Internet, like a search, will only reveal noncompliance when it is reviewed.
Dependent upon whether a simple preview search is done or full forensic examination. The more in depth the greater the need for [more sophisticated] equipment/software/training.	Software and/or service must be purchased. Little training is required to install and monitor.

TABLE 11.1

A 2008 study of 269 probation supervisory personal who used monitoring software, found broad agreement that the information was useful in determining compliance with conditions of probation while at the same time assisting treatment providers.<sup>56</sup> Seventy percent of those surveyed also indicated that the digital monitoring evidence was used in a subsequent court proceeding.<sup>57</sup>



## 11.4 BIOMETRICS

Biometrics is the science of biological measurement.<sup>58</sup> Every person has a different biometric key or traits.<sup>59</sup> There are a number of keys, but those most useful include: face, fingerprint, tattoos, palm print, iris, palm/finger vasculature [blood vessels in the fingers and hands], DNA and voice.<sup>60</sup>

Biometric keys are generally used in conjunction with other technologies such as automated supervision systems or electronic tracking. Selected keys are uploaded in the form of numeric data into the court's computer system to be kept as part of the probationer's information.<sup>61</sup> This information, called a template, uses the numeric code as a description of the probationer.<sup>62</sup> After entry, these templates are used by the computer system whenever there is a request for access.<sup>63</sup> If a template is matched, access for contact is granted; if there is no match, access is denied.<sup>64</sup> The results allow an automated computer system to verify the identity of an individual as when a cellphone picture is provided during a breath test.<sup>65</sup>

*Matching biometrics allow systems to identify an individual while performing a condition of probation such as taking a drug test.*

The first automated biometric template to be created in 1963 was to match fingerprints.<sup>66</sup> Voice, face, and signature matching quickly followed.<sup>67</sup> Within a decade, templates for hand shape and irises were developed.<sup>68</sup>

Not all biometric keys have sufficient scientific support to qualify as admissible evidence under *Daubert* or *Frye* standards.<sup>69</sup> However, this does not prevent their use with automated systems for purposes of identity confirmation in conjunction with court appearances, probation reporting, warrant verification, sex offender tracking, criminal history checks and remote automated supervision.<sup>70</sup>

## 11.5 AUTOMATED SUPERVISION

In recent years courts across the United State have been overwhelmed with growing caseloads while at the same time being put under pressure to reduce operational costs.<sup>71</sup> The struggle to do more with less resulted in a search for new ways to supervise probationers.

These efforts were also driven by recent studies which established that a low-risk, low-needs individual, as determined by a verified instrument, have higher risks of recidivism when ordered to regularly report for probation.<sup>72</sup> (See: Section 10.2.2 *Evidence-Based Sentencing—Risk/Needs Assessment* for a full discussion of risk/needs assessments and level.) As a result, remote access automated reporting systems which require less contact with the court or probation officer have emerged as an important tool in probationary supervision.<sup>73</sup>

*Automated probation supervision includes kiosks, web-based supervision and smartphone applications.*

These automated systems include kiosks, web-based supervision and smartphone applications.

Kiosk systems replace in-person reporting to a probation officer with an ATM-like computerized stand.<sup>74</sup> After an initial meeting with the probation officer, who reviews the probationer's risk/needs levels and obtains biometric keys, the probationer is required to report at a kiosk.<sup>75</sup>

The probation officer then programs the court's computer system to set the parameters of the probationer's kiosk reporting schedule including orders for random alcohol or other drug testing.<sup>76</sup> The biometric keys in the court's computer system are used to confirm the probationer's identity during kiosk reporting.<sup>77</sup>

Reporting at a kiosk generally begins with the entry of an identification number followed by a question as to which language is best for reporting.<sup>78</sup> The kiosk system then compares the biometric keys that have been previously entered into the court's computer system.<sup>79</sup>





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Once identified, the probationer is asked to update contact and employment information as well as respond to the specific questions that the probation officer entered during the initial meeting.<sup>80</sup> The offender may also make payments at the kiosk.<sup>81</sup>

Web-based supervision works in a similar manner to kiosks.<sup>82</sup> There is an initial meeting with a probation officer where program goals are discussed, and biometric keys are collected and uploaded into the court's computer system. The probationer may be given a username and password to access the system allowing him or her to report from their device at home or from any public computer.<sup>83</sup> The web reporting would then work in the same manner as a kiosk.

Most Americans own a smartphone. According to the Pew Research Center 95% own a cell phone of which 77% are smartphones.<sup>84</sup> Even among those earning less than \$30,000 a year, 92% have a cell phone, with 69% owning a smartphone.<sup>85</sup> Wide availability of cell phones and smartphones has driven the increasing use of cellular technology for probation supervision.

*A variety of “apps” have been developed to assist in cell phone supervision. They can trigger a drug test, report to probation or schedule a treatment session.*

Cell or smartphone reporting is structured in a similar manner as kiosk and web-based reporting. After an initial meeting with their probation officer, who gathers the same information as with the other forms of remote reporting, the probationer is required to report by cell phone.<sup>86</sup> Like web based and kiosks systems, the probation officer enters the parameters of the probationer's conditions into the court's computer system.<sup>87</sup> The resulting program makes automated calls to

the probationer.<sup>88</sup> These calls, like in-person meetings, have an appointment date and time,<sup>89</sup> although the computer system can also be programmed to contact the probationer on a random basis.<sup>90</sup> The computer also uses biometric keys like voice or camera to identify the individual while some programs may require the entry of a specific numeric code.

More recently, smartphone applications (apps) have been added to cell phone supervision. These apps send notifications to a probationer to take a random alcohol or other drug test, or to schedule a probation appointment or therapy session.<sup>91</sup> Some have the ability to monitor an individual's location history through the smartphone's GPS.<sup>92</sup> However, as smartphone systems cannot be securely attached to an individual like an ankle bracelet, they should not be used for home confinement or curfew restrictions.<sup>93</sup> Because a smartphone may merely be left in place, there is no way to verify if the person is actually where the phone indicates she or he is.

These apps can also be used in conjunction with Bluetooth devices such as a biometric ankle band, for such things as remote alcohol testing.<sup>94</sup> An order to install an ankle bracelet for such monitoring would be appropriate if the judge has ordered "no alcohol" as a condition of probation.

*At least three studies have concluded that automated supervision for low-risk offenders is cost-effective and either decreases the risk of recidivism or at least does not increase it.*

At least three studies have concluded that automated supervision for low-risk offenders is cost-effective and either decreases the risk of recidivism or at least does not increase it.<sup>95</sup>

The first of these studies examined the use of kiosks to supervise low-risk, low-needs offenders in New York City.<sup>96</sup> The study found that the use of kiosks was associated with a slight, but statistically significant decline in recidivism, 31% vs. 28%.<sup>97</sup>

A second study evaluated low-risk, low-needs, probationers in Hyattsville, Maryland.<sup>98</sup> The Maryland Department of Public Safety reported a more significant decline, 2% vs. 10%, in recidivism for individuals using a kiosk versus traditional in-person supervision.<sup>99</sup>

The third and largest study conducted in Rockville, Maryland, analyzed both kiosk and remote telephone reporting for low-risk, low-needs offenders in comparison to traditional supervised probation.<sup>100</sup> The authors stated: "The findings from previous studies as well as the current multi-jurisdiction kiosk study suggest that low-risk

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clients assigned to kiosk supervision are no more likely to be rearrested than are low-risk clients assigned to traditional officer supervision or to telephone reporting .

. . . ”<sup>101</sup>

The study also asserted that there was no significant difference in re-arrest rates between those who are reporting by kiosk and those who were reporting by telephone.<sup>102</sup>

## 11.6 ALCOHOL AND OTHER DRUG TESTING\*

According to the American Society of Addiction Medicine (ASAM), “The New Paradigm, embodied by these and similar programs (court ordered drug testing), has been shown to significantly reduce drug use, criminal recidivism, and incarceration. The foundation of this approach is frequent, random drug testing.”<sup>103</sup> Frequent, random, long term, drug testing makes it more difficult for probationers to find times to use alcohol and other drugs between tests.<sup>104</sup>

Most alcohol and other drugs, depending upon what the assay is testing for, can be discovered within a period between 24 to 72 hours. Testing less than twice a week creates a gap that allows probationers to use without being detected.<sup>105</sup> Studies have established that those courts that test at least twice a week reduce recidivism by 38%.<sup>106</sup>

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A schedule of random/unpredictable alcohol and other drug tests ensures an effective drug testing program.<sup>107</sup> To be effective, the probability of being tested on weekends and holidays must be the same as during weekdays.<sup>108</sup> Probationers must provide a specimen no later than eight hours after being notified.<sup>109</sup> For drug tests with short windows of detection, like oral fluid tests, probationers must provide a sample within four hours of notification.<sup>110</sup>

Drug testing should start upon entry into supervision and continue with no interruptions until the end of probation. Probationers state that long term testing helps them keep drug free and gives them refusal skills when confronted by the opportunity to use.<sup>111</sup>

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\* This section (11.6 ALCOHOL AND OTHER DRUG TESTING) was previously published by the Michigan Association of Treatment Court Professionals and written by the same author. See: BRIAN MACKENZIE & DAVID WALLACE, DRUG TESTING STANDARDS COMM. MICH. ASS’N TREATMENT CT. PROF’LS, DRUG TESTING MANUAL (2nd ed. 2017).

Testing for the full range of substances that are most likely to be used by your court probationers or in an individual community is paramount. Awareness of new substances of abuse that are constantly being sought out by offenders in order to use without detection must be added to the testing to be effective. Therefore, occasionally testing for a wider range of potential drugs of abuse will keep the program ahead of the probationers and possibly determine what new substance use might be emerging within a local population.<sup>112</sup>

### 11.6.1 Urine

While urine is the “go to” methodology for drug testing, breath, oral fluids, sweat and hair can be useful testing methods depending upon the circumstances and court needs.<sup>113</sup> Testing methodologies should be based, at least in part, on what drugs are being used in the communities that the court serves. To be admissible in a hearing, testing must use scientifically valid and use reliable methods. Appellate court decisions accept the scientific validity of several methods for analyzing urine, including gas chromatography/mass spectrometry, liquid chromatography/tandem mass spectrometry and the enzyme multiple immunoassay technique.<sup>114</sup> Courts have also ruled that some breath, sweat, oral fluid, hair, and ankle-monitor tests are scientifically acceptable.<sup>115</sup>

*Urine is the “gold standard” for drug testing and is the most common method used by courts.*

Evidence of substance use can be found in urine, blood, saliva, hair, nails, sweat and breath.<sup>116</sup> However, because of the unique make up each drug and specimen type, concentrations may vary greatly among these specimens.

Despite the variety of specimen types, urine remains the best option for court-ordered abstinence monitoring. With its longstanding history, urine is accepted as the gold standard for drug testing.<sup>117</sup> In the court system, urine testing is the most commonly used testing approach for illicit and licit drugs including alcohol.<sup>118</sup> Urine is inexpensive to analyze and offers the widest range of drugs test panels. The tests themselves are generally accurate with false negatives more likely than false positives.<sup>119</sup>



The primary problem with urine testing is its unsavory nature. Some probation officers or others tasked with collection are reluctant to do observed tests. While this is understandable, it is necessary for the integrity of the testing program that protocols, including direct observation, are followed. Urine specimens are not tamper proof. Probationers may attempt to alter specimens and are more likely to do so when they are unmonitored in collection situations or if they know beforehand when they will be tested.<sup>120</sup> Specimen adulteration can include water loading, substituting negative specimens for their own sample, or otherwise altering their samples. The risk of successful alteration is less when all sample collections are observed during collection and a random testing schedule is used.<sup>121</sup>

*All urine samples must be tested for creatinine or specific gravity to detect dilution of a sample.*

After a single episode of substance use, the detection window in urine is up to three days depending upon the characteristics of the substance being tested.<sup>122</sup>

There are two basic types of urine drug tests. The first, called the immunoassay (IA), is accurate, cost-effective and provides quick results. The second type of test is called gas chromatography/mass spectrometry (GC/MS). GC/MS uses the same procedure for obtaining a urine sample as the immunoassay but getting any results takes longer and it is more expensive; for that reason, it is often used only as a confirming test after a presumptive test is positive.<sup>123</sup>

Immunoassays urine drug screening is the most common currently used to test for substances that are abused. Immunoassays use either antibodies to detect drugs or drug metabolites which are the byproduct of the body breaking down a drug into different substances that can be detected in the urine. Laboratory animals are injected with a specific drug to produce the antibodies for each assay (for example, cocaine, PCP, etc.). Reagents containing these labeled antibodies can then be introduced into urine samples, and if the specific drug from which the antibody was made is present, a chemical reaction will occur which is read as a positive result. Even in small amounts, the reagent will react with the antibodies on the test device. If the drug or drug metabolite is not present or is not present above the cutoff level, it will result in a negative test. The various handheld tests or point of contact devices, and automated analyzers for urine are all immunoassays.

All urine testing technologies utilize specified antibody quantities that provide known immunoassay cutoff levels. A negative urine assay result does not necessarily prove that the subject did not consume the substance. Rather it may be that there simply was not enough of the substance in the donor's system to exceed the cutoff level.

Detection of substances in urine is affected by urine dilution; therefore, creatinine and/or specific gravity values, which can indicate dilution, should be reported out and taken into consideration on all urine tests.

There are two different types of immunoassay screenings: automated laboratory analyzers and Point of Collection Testing (POCT) devices.

Automated laboratory analyzers target metabolites because they are discharged over a longer period of time than the actual drugs themselves and therefore provide a better opportunity to detect use.<sup>124</sup> Some compounds are also considered representative of a drug class. For example, cocaine assays do not target cocaine because it has a short period of excretion.<sup>125</sup> Instead, they target an inactive metabolite unique to cocaine because it has a much longer window of excretion.

During automated laboratory analyzer testing, a chemical reaction occurs that changes the light-absorbing properties of the test mixture. Special instruments called spectrophotometers measure the changes in the amount of light the sample absorbs, which is related to the amount of drug or drug metabolite the sample contains. The more drug or metabolite present in the person's urine, the greater the response produced. If there is little or no drug present in the sample, the response is lower.

The sample's response is compared to the response of a calibrator which contains a known quantity of the drug in question. This known quantity of drug in the calibrator is the cutoff. If the sample's response is higher than or equal to the calibrator's the sample is considered positive for the particular substance. If the sample's response is less than that of the calibrator, the sample is considered negative.

Court testing programs using automated analyzers must be sure the laboratory operates according to the manufacturer's specifications and timetable. All personnel

responsible for running samples should be required to complete any manufacturer training and follow all recommended maintenance and operational instructions.

The potential disadvantage of all immunoassays, including automated laboratory analyzers, occurs when an antibody cross-reacts with a compound outside the class of drugs the analyzer is designed to detect. This can result in a false positive. Cross-reactivity problems differ between manufacturers and even between lots of reagents.<sup>126</sup>

POCT, which relies on IA technology, is currently limited to a relatively narrow range of drug classes and a few specific drugs (usually 15 or less). POCT systems vary in design and the number of drugs tested. Generally, these systems are multi panel strips or urine test cups.<sup>127</sup> Each one is designed to test for multiple substances or metabolites at the same time. Each panel is a separate drug test and needs to be read independently of one another. Regardless of what design is chosen, it is very important that court-testing programs follow the manufacturer's instructions for using the device. These devices usually involve submerging a dipstick into the urine sample, using a pipette to draw out a small amount of urine to be placed on a test cassette or having the test built into the specimen container. Once the urine comes into contact with the testing device the collector must allow the manufacturer's recommended amount time to pass before "reading" the device for a result. This information can be found on the cup's instructions.

Generally, these devices have colored bands next to each drug being tested indicating whether a drug is present or absent in the particular sample. Most of these devices will also have a "control" band ("C") designed to ensure the testing device is performing according to the manufacturer's specifications. A test should be considered invalid if no colored band (line) appears in the control region (C) of the device. The drug or "test" bands ("T") indicate whether the testing device has detected a specific drug. The design of the point of contact devices vary with some devices testing for a single drug while others contain multiple channels testing for many drugs. Each drug will have its own separate color band. When a colored band/line appears in the drug or test region (regardless of the intensity of the color), the test is considered negative. The absence of a colored band/line next to a drug or test region indicates a "presumptive" positive result.



It should be noted that POCTs have expiration dates and handling instructions. Test kits that are ripped, torn, or past their expiration date should not be used. All kits should remain unopened until ready for use.

The potential disadvantages of POCTs include the subjective nature of the assays, questions about the integrity of the test reagents following transportation and storage, the possible lack of adequate quality assurance and quality control, data management issues and staff training issues.<sup>128</sup>

### 11.6.2 Breath

Breath is the current standard specimen for alcohol testing.<sup>129</sup> Alcohol evaporates from the blood into the lungs and is excreted in breath, allowing it to be measured in a breath sample.<sup>130</sup> Breath tests are currently limited to alcohol as there are no current scientifically valid tests for other drugs using breath.<sup>131</sup> However, new breath technologies are under development, so that breath testing for other drugs may become available in the future.<sup>132</sup>

The Breathalyzer<sup>133</sup> or the Preliminary Breath Test (PBT)<sup>134</sup> are devices which produce an estimate of Breath Alcohol Content (BrAC) based upon the chemical analysis of an expired breath sample. These devices generally have a liquid crystal display (LCD) screen where the BrAC is displayed. For PBTs, which are handheld devices, readings generally are manually recorded, as some devices have no print capability. PBTs are easy to use, portable and relatively low cost and they must be calibrated monthly by a certified technician to ensure accurate readings. Breathalyzers, larger and typically stationary, will have a printout of the results. They must have an accuracy check run each calendar week.

*Some courts are using interlocks and home breath testing devices as a form of daily or random breath testing when abstinence is a condition of probation or release from custody.*

In addition to ordering probationers to place an interlock device in their automobiles to prevent them from driving after they have consumed alcohol, some courts are using interlocks and home breath testing devices as a form of daily or random breath testing when abstinence is a condition of probation or release from custody.



An interlock is a breath-testing device attached to a vehicle's electrical system that requires the probationer to submit to a breath test before the vehicle will start. If alcohol is detected at or above a cutoff level, the vehicle will not start. If no alcohol is detected, the vehicle will start.

*It is Best Practice to require interlocks or home breath devices to have cameras.*

Monitoring occurs when the probationer is required to go to an installer to have the ignition interlock device calibrated. While at the installation center, the instrument is checked to make sure it is working properly, and a report is taken from the instrument's computer. If there is a positive sample, it will be recorded with each subsequent sample to show whether or not the reading was in fact alcohol or if it was an interferent.

In-home breath devices are portable versions of an interlock. They are commonly ordered in some states as an alternative to onsite appearance breath testing. This is frequently done for probationers who don't drive or don't own vehicles.

Most interlocks and home breath testing devices have cameras attached. The device takes the test subject's picture and makes it available to the monitoring authority for photo-matching. If a court is using interlocks or home breath testing devices for alcohol monitoring, it is a best practice to require ones with cameras.<sup>135</sup>

### 11.6.3 Oral Fluids

Oral fluid testing<sup>136</sup> analyzes a saliva sample for drugs and their metabolites.<sup>137</sup> An absorbent collection device is placed in the mouth and the saliva collected which is then screened for drugs of abuse. Samples are checked to verify the saliva is human and undiluted.

Over time oral fluid testing has grown in acceptance and use.<sup>138</sup> This shift has been driven by the fact that it now can detect more illicit drugs because of the improvements in drug testing technologies.<sup>139</sup> Oral fluid testing provides an ease of specimen collection and eliminates the problem of gender matching as would be required in an observed urine test. It is readily available and non-intrusive. However, oral fluid testing offers fewer test panels beyond what is offered for urine testing, although because of oral fluid testing's growth, broader panels are expected



to become commercially available.<sup>140</sup> Some concerns have been expressed about oral testing because of low specimen volume of test material from the use of a swab and the resulting difficulty these low levels of materials create in confirming tests.<sup>141</sup> The detection window for Tetrahydrocannabinol (THC), the active ingredient in marijuana, is minimal, typically just within a few hours of use.<sup>142</sup> The window of detection for other drugs in oral fluid is generally 12 to 48 hours, which is somewhat shorter than for urine.<sup>143</sup>

Currently, to use oral fluid technology, testing programs must send their samples for confirmation testing to a reference laboratory to detect drugs and drug metabolites in saliva samples.

This method may be useful in some settings for on the spot testing or home visits, however its limitations suggest it should not be the primary method in a court setting in which timely responses to substance use is necessary.

### 11.6.4 Sweat Patches

Sweat patch technology<sup>144</sup> has some benefits over urine and other types of testing since it is relatively non-invasive and it is worn 24 hours a day for an extended period of time. The band-aid like patches are designed to be tamper resistant, with adhesives that can only be removed using special solvents. Once the patch is removed it is sent to a laboratory for testing. Although no immediate results are available, the patch is able to capture what alcohol and other illicit drugs the client may have used over an extended period of time.

There have been documented cases where clients have been able to heat and then dissolve the adhesive allowing them to place barriers between the patch and skin. The patches are then reattached to the skin to create the illusion of wearing the patch. When it is known the patch will be removed for analysis, the client may again dissolve the glue to remove the barrier and re-adhere the patch. A slice of bologna is a common barrier.

One study in 2010 claimed the use of sweat patches did not improve outcomes in a drug treatment court when used in conjunction with urine testing.<sup>145</sup> However, it is important to note that the study was conducted with both urine and sweat patch testing and it did not examine sweat patches as the sole type of testing.<sup>146</sup>

When a person drinks alcohol a small amount can be detected in their “insensible sweat” or perspiration. Ankle bracelets use transdermal technology to test the concentration of alcohol present in perspiration that is given off by the skin.<sup>147</sup>

### 11.6.5 Transdermal Ankle Bracelets

Transdermal ankle bracelets do not detect blood alcohol concentration (BAC) levels; instead they test for alcohol based on the transdermal alcohol content (TAC). These results are equivalent to BAC results. However, as the body absorbs alcohol, TAC peaks generally occur two hours after a BAC peak.<sup>148</sup> These ankle bracelets measure TAC and stores the data for upload to computers for reporting and analysis.<sup>149</sup> The data is then provided to court staff. Any attempt to remove or tamper with the bracelet, is communicated to the company that provided the instrument when the TAC data is uploaded.<sup>150</sup> Attempting to prevent a data upload will also be reported.

Some transdermal bracelets now have GPS<sup>151</sup> built into them. Consequently, some courts have also used the devices as house arrest monitors to track probationer movements, particularly if the court has imposed curfews or restraining orders.<sup>152</sup> They should be used to test for alcohol over a prolonged period of time.<sup>153</sup>

Recently, a flexible wearable sensor has been developed that can accurately measure a person’s blood alcohol level and transmit the data wirelessly.<sup>154</sup>

Overall, while these transdermal devices have historically been expensive, they have confirmed low levels of drinking.<sup>155</sup>

### 11.6.6 Hair/Nails

Hair/nail testing has some benefits similar to sweat patches, since it can detect use over a long period of time.<sup>156</sup> If the drug was recently used, it does take some time (up to five to seven days) for it to show up in the hair shaft.<sup>157</sup> Because head hair grows at a rate of about 1/2 inch per month, 1 1/2 inches of hair may provide information on drug use for 90- day period.<sup>158</sup>

Hair/nail testing is useful when looking to detect any drug use over a period of time. However, the results of this test can be misleading for clients who have used in the past but are not currently using.<sup>159</sup> It may be more appropriate to use this test as a

baseline test rather than for regular probationer testing. Similar to a sweat patch, hair/nails specimens are collected and then sent to an external laboratory for testing.

Probationers can limit the impact of this form of testing either accidentally or deliberately such as when a man shaves his head in an attempt to limit the testing availability. Similarly, when a woman colors or bleaches her hair it may cause some degradation of the drugs being tested for.<sup>160</sup> In addition, there is some concern that some hair colors (darker hair) may retain some drugs differently or longer than lighter colored hair.<sup>161</sup>

When testing nails, individuals with shorter nails can make collection difficult. However, nails are less likely to be affected by any external exposure to dyes or chemicals because they are thicker than hair.<sup>162</sup>

Among the disadvantages of hair/nail testing is that some drug classes like benzodiazepines are poorly detected in hair.<sup>163</sup> In addition this form of testing can be expensive.<sup>164</sup>

### 11.6.7 Blood

Most of the early drug testing used blood as there was no other methodology.<sup>165</sup> A blood test is difficult to adulterate, and it is very accurate.

The liver influences the absorption and conversion of drug metabolites in blood.<sup>166</sup> This means only a fraction of the drug reaches the bloodstream. Thus, detection time in blood for drugs is significantly shorter than the other methodologies. In fact, for opioids, cocaine, and amphetamines the detection time in blood is generally 24 hours or less.<sup>167</sup>

Another concern about blood testing is that it requires medically trained staff to obtain a specimen, thus making it difficult for a police agency to obtain. It is also time consuming and expensive stemming in part from the requirements that it be treated as biohazard material.

## 11.7 ATTEMPTS TO DEFRAUD THE TEST

Probationers will endeavor to defraud chemical tests. These efforts include, dilution, adulteration, and substitution. Court staff members should be trained on how to implement countermeasures to prevent and identify tampered test specimens.<sup>168</sup>

Ensuring that the probationer is the person providing the specimen is critical to reliable results. Courts and testing agencies cannot allow a different individual to take the place of the person who needs to be tested. Therefore, verifying the donor's identity is fundamental to good collection procedures.

Drug test samples in a court setting must be considered a form of forensic evidence.<sup>169</sup> Therefore courts must create policies and procedures that control

*To prevent attempts to defraud the test, all submitted test samples should: 1. Be witnessed; 2. Inspected for evidence of dilution; and, 3. Provided timely.*

specimen handling including such considerations as chain of custody documents, sample containers and storage compartments.<sup>170</sup>

Sample collection is a critical component of an effective drug-testing program. The collection of valid samples is the necessary first step to an objective program.<sup>171</sup>

Witnessing a collection is essential. All sample collections must be observed; those not witnessed are of little or no assessment value.<sup>172</sup> To that end

courts must require that all specimen collection is witnessed in a gender appropriate manner.

Collecting a valid sample is necessary in order to determine a probationer's drug use behavior. All specimens should be routinely inspected for evidence of dilution and adulteration including testing for creatinine, pH, oxidants and specific gravity.<sup>173</sup>

Drug testing results must be reliable, and they must be provided in a timely fashion. Courts must have results that are both valid and legally defensible.<sup>174</sup> However, a procedurally fair court needs those results quickly so that impact of the results is therapeutically beneficial.



## 11.8 IN THE COURTROOM

To be admissible in a court proceeding, the tests must use scientifically valid and reliable methods.<sup>175</sup> Confirmation of a presumptive test should be made with an instrumented test that virtually eliminates the odds of a false positive result.<sup>176</sup> Courts should establish a procedure to ensure a valid chain of custody for each specimen.<sup>177</sup> Results falling below recommended cutoff levels should not be interpreted as evidence of new substance use.<sup>178</sup>

Timing is one of the most influential factors for testing success. The sooner the court imposes sanctions for a positive test or provides an incentive for a negative test, the better the probationer can maintain sobriety. Negative test results should be reported no later than one day after a sample is provided and positive results should be received by the court within two days if confirmation testing is requested.<sup>179</sup>

*Probationers themselves reported that drug testing is one of the strongest factors that kept them from using.*

When it comes to alcohol and other drug testing it is all too easy to draw unwarranted conclusions. Judges should understand that their first role is to be a gatekeeper when dealing with the results of a positive alcohol or other drug test. In that role they have a duty to decide if the drug test is admissible under either the *Daubert* or *Frye* standards.

When judges are also the finders of fact, they should rely upon the evidence that is entered into the record and not speculate or draw unsupportable conclusions. Simply because a judge has become familiar with alcohol and drug test results does not make them an expert.

One all too common courtroom response is to assume that higher concentrations in a test necessarily means that the probationer was heavily using. For many tests there is no scientific consensus that supports that conclusion. Test results can be misleading, if not correctly interpreted; therefore judges should always remember that they are not toxicologists. They can take the evidence as it is entered into the



record, but they may not speculate beyond that. Another common error is to assume that higher THC levels in a test done near in time with another means new use; it doesn't.

When it comes to supervision of high-needs probationers,<sup>180</sup> aggressive alcohol and other drug testing is a necessity. The authors of the "THE MULTI-SITE ADULT DRUG COURT EVALUATION" wrote in their executive summary:<sup>181</sup> "Across multiple methods, among the most consistent findings were that offenders who received higher levels of ... drug testing, ... reported fewer crimes and fewer days of drug use." The study concluded:<sup>182</sup> "Testing was significantly related to reductions in crime and drug use...."

Another study of drug treatment courts who supervised high-risk, high-needs probationers found that testing two or more times per week throughout probation produced significantly greater benefits including lower recidivism rates.<sup>183</sup> Probationers themselves reported that drug testing is one of the strongest factors that kept them from using.<sup>184</sup>



### 11.9 CONSTITUTIONAL AND LEGAL CONSIDERATIONS

There are three predicate conditions essential to a probation order that includes the use of technological devices.<sup>185</sup> First, an order must be constitutional.<sup>186</sup> Second, it must be reasonably related to the protection of society and/or the rehabilitation of the probationer.<sup>187</sup> Third, the results produced by the device must be admissible under *Frye* or *Daubert* standards.<sup>188</sup>

The United States Supreme Court has held that once an individual has been convicted of a crime and placed on supervision, they suffer a reduction in their constitutional rights.<sup>189</sup> Thus, it has held a warrantless search of a home is not a violation of an individual's privacy rights if they are under supervision.<sup>190</sup> Lower courts relying on *Griffin* have held that a probationer's Fourth Amendments rights are not violated by the use of an electronic monitoring device.<sup>191</sup>

While probationers do not lose all of their due process rights according to the Supreme Court,<sup>192</sup> lower courts have found that the imposition of electronic monitoring is not punishment and therefore, does not raise a due process issue.<sup>193</sup>

Courts have also found that the imposition of an electronic tracking device to enforce home confinement is not cruel and unusual (thus violative of the Eight Amendment), as it is less restrictive than incarceration.<sup>194</sup>

Hearsay information contained in a probation officer's report can be admitted into evidence as probationers only have a qualified right to confront and cross-examine a witnesses in a probation violation hearing.<sup>195</sup> A probationer's demand to question a laboratory technician about the results of a drug test result can be denied for good cause.<sup>196</sup> However, at least one court has rejected the admission of a police report containing the results of a breathalyzer test where the probation officer did not speak with and could not attest to that police officer's training or ability to use the breath testing device.<sup>197</sup>

The equal protection clause is not violated by requiring drug testing and/or the use of the GPS for tracking.<sup>198</sup> However, a court has found that remanding a defendant to jail, who could not afford a home detention monitor, was a violation of equal protection based on indigency.<sup>199</sup>

Courts of have also rejected claims that a new charge arising from a violation of electronically supervised probation does not raise a question of double jeopardy or prevent the court from sentencing on the original charge.<sup>200</sup>

The imposition of the special conditions, such as alcohol or other drug testing or the requirement to use an electronic tracking device must relate to the goals of probation. Where there is no evidence that justifies a special condition, appellate courts have invalidated them.<sup>201</sup> However, appellate courts tend to apply a test that is similar to an abuse of discretion standard when examining lower court orders. As long as there is a reason to impose the condition the order will be upheld.<sup>202</sup>

The standards for admissibility of scientific and technological evidence in post judgment proceedings are less stringent than at trial.<sup>203</sup> For instance, while hearsay evidence can be introduced to lay the foundation for the results from a tracking or testing technology, they must meet recognized scientific standards.<sup>204</sup> The burden of meeting those standards still remains upon the party offering the evidence.<sup>205</sup>

Chain of custody is an issue in a post judgment proceeding. In order to ensure the admissibility of technological test results, court supervisor staff should follow procedures which should include a custody form signed by the probationer or court staff responsible for the results from the technological device.<sup>206</sup> When results are outsourced, as may be in the case in drug testing, staff should have receipts that can be attached to the chain of custody form and they should inspect each package for possible tampering.<sup>207</sup>

If it appears that evidence may have been tampered with, that should be reported immediately to appropriate personnel.<sup>208</sup> Any tampering event should be noted on the chain of custody form.<sup>209</sup>

The device itself, if possible, should be available for admission into evidence in order to demonstrate a lack of damage or in the case of possible tampering tool mark evidence or cut straps.<sup>210</sup> In addition, photographs should be taken of the device in the event the device is not available.<sup>211</sup>

Evidence taken from a tracking device, such as DNA left on the device, can be preserved and used to establish a link in the chain of custody.<sup>212</sup>



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Documentary evidence either in the form of test results or reports should be created to be offered into evidence.<sup>213</sup> The data recorded by and transmitted from a technological device must be documented.

A probationer must obey the directives of the probation officer regarding alcohol and other drug testing, reporting or use of tracking devices if the officer has correctly interpreted the court's order.<sup>214</sup> At least one court has decided that a probation officer has the authority to order a drug test, even in the absence of a court order.<sup>215</sup>

## 11.10 CONCLUSION

Neither science nor the law stand still. Recent technological advances provide an opportunity to improve supervision and monitoring of probationers. However, not every technological advance is appropriate in a court ordered supervision context. Some technologies have yet to produce results that would be admissible under *Frye* or *Daubert* standards.

A judge does not have to understand all the specialized nuances associated with the many technological tools that can assist in probation supervision. However, even a limited understanding of these technologies combined with a clear understanding of the applicable law will improve probationary outcomes and reduce recidivism. Therefore, it is important for judges to become informed about the scientific and technological innovation that is changing probationary supervision.





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An abstract graphic featuring a teal wireframe mesh that forms a series of overlapping, flowing loops. Scattered throughout the background are small, light-colored numbers (0-9) in various orientations, giving it a digital or data-driven appearance.

# 12. CIVIL POST TRIAL PROCEEDINGS

Sections 12.1 - 12.4

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**HON. JOSEPH MALTESE &  
HON. BRIAN MACKENZIE (RET.)**

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## 12.1 OFFERING NEW SCIENTIFIC EVIDENCE POST JUDGMENT

After the jury renders a verdict for either the plaintiff or defendant, then the losing parties' counsel will typically renew their motions to dismiss the case again for failure to prove a *prima facie* case and/or to set aside the jury's verdict as against the weight of the credible evidence, or, in general, for a judgment notwithstanding the verdict (JNOV). Most courts will allow these dispositive motions to be made in writing where the parties can articulate, with specific references to the trial record, why the judgment should be set aside.

The Federal Rules of Civil Procedure (FRCP) 59 – New Trial; Altering or Amending a Judgment and FRCP 60 – Relief from a Judgment or Order provide the guidelines for post judgment motions involving scientific evidence.

One of the reasons specified in these motions to set aside the verdict is because the judge allowed testimony and/or other evidence to be admitted over the objection of the opponent. A classic civil case where this occurred in the realm of scientific evidence which was appealed to the U.S. Supreme Court was the case of *Weisgram v. Marley*, 528 U.S. 440 (2000). The following is a summary of that case. The facts in *Weisgram* flow from the death of Bonnie Weisgram who died due to carbon monoxide poisoning during a fire in her home. Her estate brought a strict products liability action alleging that either a defectively designed or defectively manufactured electrical heater caused both the fire and her death. Plaintiffs presented, over defendant's objections, three expert witnesses. The first expert was the fire captain on the scene who testified about the cause and origin of fires. However, over the objection of the defendants, he was allowed to opine that the electrical heater malfunctioned and that a vinyl floor and glue caused vapors that were ignited by the electrical heater.

The second expert was a "fire investigator" and "technical forensic expert," who was a master electrician in Ohio with experience in consulting on electrical fires. He was allowed to testify over defendant's objection. While never visiting the scene of the fire, nor performing any tests of a similar heater, he opined that the "volatile vapors from the adhesive (the linoleum glue) came into the location of the heater and caused the fire."



The third witness, a metallurgist, was qualified in the properties of metals, but not in fire causation and origins in baseboard heater operation, or in the design or testing of the metal contacts in such a unit. None of the plaintiff's experts ever tried to replicate the fire through testing a similar heater. The jury rendered a verdict in favor of the plaintiff in the sum of 5 million dollars. Defendants post-trial motions to dismiss were also denied.

The Eighth Circuit Court of Appeals, reversed the District Court as it found it had abused its discretion in erroneously admitting scientific opinions, which did not follow any scientific or technical methodology, but were instead based upon speculation and the *ipse dixit* of the proffered expert. The court then held that under FRCP. 50, the case need not be remanded for a new trial with a new expert, but can be dismissed outright by the court. The United States Supreme Court affirmed and directed entry of a dismissal without a new trial and alternative experts for the plaintiff. Justice Ginsberg writing for the majority said:

Since *Daubert*, moreover, parties relying on expert evidence have had notice of the exacting standards of reliability such evidence must meet.<sup>1</sup> It is implausible to suggest, post-*Daubert*, that parties will initially present less than their best expert evidence in the expectation of a second chance should their first try fail. We therefore find unconvincing Weisgram's fears that allowing courts of appeals to direct the entry of judgment for defendant will punish plaintiffs who could have shored up their cases by other means had they known their expert testimony would be found inadmissible . . . . In this case, for example, although Weisgram was on notice every step of the way that Marley was challenging his experts, he made no attempt to add or substitute other evidence.<sup>2,3</sup>

The court concluded that in order to avoid a dismissal, the valid [scientific] theory or methodology must be explored before proposing an expert opinion. Attorneys may not get another opportunity to change theories and experts after the motion to dismiss is granted at any stage of the proceedings: the pre-trial, during trial or post trial. There are no do-overs with a more qualified expert.

Courts will allow a do-over when the judge commits an abuse of discretion by allowing or excluding scientific expert testimony without properly applying *Daubert* criteria.<sup>4</sup>

The situation in states following the *Frye*<sup>5</sup> standard is more complex with some states allowing parties a second chance to obtain a new expert witness should their first try fail.<sup>6</sup> Therefore, judges in states following *Frye* should carefully examine their existing caselaw and apply the appropriate standards.

*Appellate courts will allow a 'do-over' when the trial court commits an abuse of discretion by allowing or excluding scientific expert testimony without properly applying Daubert criteria.*



## 12.2 CIVIL COMMITMENTS OF SEXUALLY VIOLENT PREDATORS

Civil commitments for sexual violent predators (SVP) generally follow a statutory scheme similar to those that allows a state to place someone who has mental illness in a mental institution when they pose a danger to themselves or to others.<sup>7</sup> Although these laws vary from state-to-state, in the main they share three common elements:

1. “the individual must have committed a qualifying sexual offense;
2. the individual must have a qualifying mental condition; and,
3. the individual’s mental disorder creates a high probability that the person will commit new sexual offenses in the future due to a serious difficulty controlling his or her behavior.”<sup>8</sup>

The Supreme Court in a 5 to 4 decision in *Kansas v. Hendricks*<sup>9</sup> upheld the Kansas SVP law as it was a civil action, not criminal, and could not violate the double jeopardy or ex post facto clause of the Constitution.<sup>10</sup> The Court further held that the requirements for commitment in the Kansas statute were sufficient to rebut any claims of violation of substantive due process requirements.<sup>11</sup>

The expert testimony provided by mental health professionals in SVP cases requires them to stuff medical diagnoses into the context of statutory language in effect, translating a mental health diagnosis to meet the legal elements necessary to support a judge ordering a civil commitment.

*Not all mental health professionals are experts in probabilistic theory and may need to rely on other’s work. This in turn may raise gatekeeper questions that a judge must be aware of in states following Daubert.*

The first two elements required to prove an individual is a “sexually violent predator” tend not to be problematic under either *Frye* or *Daubert* standards, as most mental health professionals are qualified to render an expert opinion. The third element, predicting future dangerousness, often requires the use of a probabilistic

prediction model.<sup>12</sup> Not all mental health professionals are experts in probabilistic theory and may need to rely on other's work. This in turn may raise gatekeeper questions that a judge must be aware of in states following *Daubert*.

Courts in *Frye* criteria states by and large avoid this issue. As the Pennsylvania Supreme Court held in *Commonwealth v. Dengler*<sup>13</sup> under a traditional *Frye* analysis, that there is no need to conduct an evidentiary hearing regarding a sexual offender's likelihood of recidivism, because such evidence is not novel. The court held a *Frye* hearing is not required every time science comes into the courtroom; rather, only when the expert testimony involves novel science. It reasoned that because the legislature had provided a statutory framework defining when an individual is a sexually violent predator it must be generally accepted in the community of professionals who conduct such assessments and therefor, cannot be deemed "novel science."

On the other hand, the Illinois Court of Appeals in *In re Commitment of Field*<sup>14</sup> found that a trial court erred when it allowed in an actuarial instrument offered by the state without establishing that it had gained general acceptance in the psychological community that evaluates the risk of sex offender recidivism.

Courts in *Daubert* criteria states have a more complex task. In a decision that came down before *Daubert*, the Supreme Court in *Barefoot v. Estelle*,<sup>15</sup> held a Texas jury could sentence a defendant to the death penalty based upon two psychiatric experts testifying as to defendant's future dangerousness neither of whom had examined the defendant. The American Psychiatric Association (APA) filed an amicus brief containing a ferocious scientific assault on the state expert's prediction testimony. However, the Supreme Court rejected the APA's arguments, holding as there was no Constitutional bar preventing a state from requiring a jury to consider future dangerousness, there was likewise no limit on the methods a state could use to meet the burden, including the use of psychiatric testimony.

The court's subsequent decision in *Daubert* suggested to some legal commentators that the rationale of *Barefoot* had been effectively overruled as it was "fundamentally at odds with the Court's pronouncement in *Barefoot*."<sup>16</sup> However, the Fifth Circuit Court of Appeals in *Johnson v Cockrell* rejected this argument stating: "We also



disagree that Johnson could have persuasively argued to the district court that *Daubert* ... altered the admissibility of this type of evidence after *Barefoot*. Johnson cites no authority questioning the continued validity of *Barefoot*.”<sup>17</sup>

The reasoning of *Cockrell* and other cases that have reached similar holdings have been criticized. The Supreme Court of Arizona in *Logerquist v. McVey*,<sup>18</sup> found *Barefoot* and *Daubert* to be irreconcilable: “*Daubert* does not mention *Barefoot*. Perhaps the Court intends to interpret Fed. R. Evid. 702 differently in criminal cases. But as the earlier survey of our cases shows, in criminal prosecutions we have not subjected testimony seeking to explain human behavior to any preliminary gatekeeping test of reliability. We do not believe different tests should apply in civil cases; to the contrary, rules determining the competency of evidence should apply across the board, whether the case is on the civil or criminal calendar. We find it hard to believe that evidence deemed admissible in prosecutions resulting in imposition of death or long terms of imprisonment should be held unreliable and therefore inadmissible in tort cases based on the same type of act that leads to many criminal prosecutions.”

*In a review of sexual violent predator cases found under this flexible approach there were virtually no appellate decisions upholding challenges to expert prediction testimony.*

The Texas Criminal Court of Appeals in *Coble v. State of Texas*<sup>19</sup> another death penalty case, also rejected the argument that *Barefoot* and *Daubert* could be reconciled. The court noted that all parties agreed the state’s psychiatrist was clearly qualified to testify as to the defendant’s mental health and to diagnosis that condition. It held however, that the trial judge abused his discretion by allowing testimony on the question of the defendant’s future dangerousness saying: “Based upon the specific problems and omissions cited above, we conclude that the prosecution did not

satisfy its burden of showing the scientific reliability of [the expert’s] methodology for predicting future dangerousness by clear and convincing evidence during the *Daubert/Kelly* gatekeeping hearing in this particular case.”<sup>20</sup>

In yet another death penalty case, the court in *Flores v Johnson*<sup>21</sup> noted that *Barefoot* was decided before a better understanding of the science was reached and held that: “On the basis of any evidence thus far presented to a court, it appears that the use of psychiatric evidence to predict a murderer’s ‘future dangerousness’ fails all five *Daubert* factors.”

*Daubert* criteria courts reviewing decisions about civil commitments under SVP statutes have developed a “flexible approach”<sup>22</sup> to the admission of expert testimony about future dangerousness. This approach is typified by the case of *Andrews v. State of Florida* which held:

Other courts have recognized that ‘the *Daubert* factors do not necessarily apply easily when considering the testimony of a mental health expert’ . . . . “However, while courts seem to be in agreement that psychiatric and psychological expert opinions are difficult to analyze under *Daubert*, there also seems to be agreement that these opinions can be admitted because *Daubert* employs a flexible approach.”<sup>23</sup>

A review of SVP cases found under this flexible approach there were virtually no appellate decisions upholding challenges to expert prediction testimony.<sup>24</sup> This failure to rigorously apply *Daubert* criteria in SVP cases has suggested to some commentators that courts are avoiding their gatekeeper responsibilities.<sup>25</sup>

### 12.3 CONCLUSION

Second chances are rare in the law. Students are taught in law school that putting an end to litigation by according a finality to judgments is a central objective of modern civil procedure. The goal of all litigation is a final judgment. Judges resist reopening the evidentiary record for any reason let alone one that is based upon the testimony of an expert witness.

## 12.4 ENDNOTES


1. Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579; *see also* Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999) (rendered shortly after the Eighth Circuit’s decision in *Weisgram*); General Electric Co. v. Joiner, 522 U.S. 136 (1997).
2. *See* Lujan v. National Wildlife Federation, 497 U. S. 871, 897 (1990) (“[A] litigant’s failure to buttress its position because of confidence in the strength of that position is always indulged in at the litigant’s own risk.”).
3. Weisgram v. Marley, 528 U.S. 440 at 456 (2000).
4. General Electric Co. v. Joiner, 522 U.S. 136 (1997).
5. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).
6. *See e.g.* Guzman ex rel. Jones v. 4030 Bronx Blvd. Associates L.L.C., (861 N.Y.S.2d 298 (2008)).
7. L.C. Hedman, *et al.*, *State Laws on Emergency Holds for Mental Health Stabilization*, 65 PSYCHIATRIC SERVS. 529, 529-35, (May 2016). <https://ps.psychiatryonline.org/doi/10.1176/appi.ps.201500205>
8. ASSOC. FOR THE TREATMENT OF SEXUAL ABUSERS, CIVIL COMMITMENT OF SEXUAL OFFENDERS: INTRODUCTION AND OVERVIEW (2015). <http://www.atsa.com/sites/default/files/%5BCivil%20Commitment%5D%20Overview.pdf>
9. Kansas v. Hendricks, 521 U.S. 346 (1997).
10. *Id.*
11. *Id.*
12. GEORGE G. WOODWORTH & JOSEPH B. KADANE, EXPERT TESTIMONY SUPPORTING POST-SENTENCE CIVIL INCARCERATION OF VIOLENT SEXUAL OFFENDERS, 3 LAW, PROBABILITY & RISK 221 (2004).
13. Commonwealth v. Dengler, 890 A.2d 372 (Pa. 2005).
14. In re Commitment of Field, 813 N.E. 2nd 319 (Ill. 2004).
15. Barefoot v. Estelle, 463 U.S. 880 (1983).
16. Daniel Shuman, *Science, law, and mental health policy*, 29 OHIO N.U. L. REV. 587 (2003).

## 12. CIVIL POST TRIAL PROCEEDINGS

17. Johnson v. Cockrell, 306 F.3d 249 (5th Cir. 2002).
18. Logerquist v. McVey, 1 P.3d 113 (Az. 2000).
19. Coble v. State, 330 S.W. 3rd 253 (Tex. Crim. App. 2010).
20. *Id.*
21. Flores v. Johnson, 210 F.3rd 456 (5th Cir. 2000).
22. Kumho Tire Co., Ltd. v. Carmichael, 526 U.S. 137 (1999).
23. Andrews v. State, 181 So. 3d 526, 528 (Fla. Dist. Ct. App. 2015).
24. Christopher Slobogin, *Dangerousness and Expertise Redux*, 56 EMORY L.J. 275, 295 (2006).
25. Melissa Hamilton, *Public safety, individual liberty, and suspect science: future dangerousness assessments and sex offender laws*, 83 TEMP. L. REV. 697 (2011).



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An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops. The background is dark, and the mesh is overlaid with a pattern of small, light-colored numbers (0-9) scattered across the surface.

# 13. CONCLUSION

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**HON. PEGGY HORA (RET.)**

**HON. BRIAN MACKENZIE (RET.)**

**DAVID J. WALLACE, ESQ.**

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## 13.1 JUDGES: THE GATEKEEPERS OF SCIENTIFIC EVIDENCE

Judges cannot and should not try to become scientists. The nature of the bench requires that they be generalist in the area of knowledge and specialists in the law. As legal specialists, judges must be the gatekeepers of scientific expert testimony in the courtroom. They must decide whether to admit or exclude the testimony of witnesses claiming scientific expertise. They must play this role to ensure that the fact-finder has accurate scientific opinion evidence in order to reach a just verdict.

The introduction of scientific expert evidence does not require a judge to become an expert but only to decide what scientific facts and opinions will assist, and not unduly prejudice, the trier of fact.

We are now learning that evidence that was once thought to have a scientific basis, i.e., bite mark “evidence,” was simply unsupported opinion. When such evidence is allowed to be presented to the trier of fact it distorts the search for truth in the courtroom.

Judges must then take on the role of scientific gatekeeper by ensuring that all experts are reliable and are asked to explain the theoretical and factual basis for their opinions; the science upon which it is based; and, equally important, any limitations of their conclusions.

Judges should work to ensure that scientific experts present their testimony in a manner that accurately conveys the scientific facts and avoids speculation and unsupported opinion evidence. Scientific experts, therefore, should not be allowed to testify beyond the scope of their expertise. This includes preventing them from testifying about opinions that are beyond the limits of known scientific fact.

Judges should feel empowered to retain the services of scientific experts if they question the parties’ experts to better assist the trier of fact. Court-appointed experts can be of great assistance in both bench and jury trials.

Experts should not be allowed to testify about conclusions that were not contained in response to discovery requests unless it is a truthful answer raised on cross-examination. The days of “ambush by trial” are over.

Judges should conduct the voir dire of a scientific expert outside the presence of the jury if there is a challenge to the competency or reliability of the expert. The proponent of the expert testimony should be allowed to question an expert about facts or opinions beyond the opinion submitted in discovery or the limits of scientific protocols.

Finally, attorneys should not be allowed to mischaracterize expert evidence in their comments to the jury. To enforce this judicial function, the judge should understand basic statistics and research methods as found in this Bench Book.

Judges need the legal ability to respond to the new demands of science. The gatekeeper role where complex scientific theories can be presented and applied or rejected is integral to obtaining a just result.

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An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. The background is dark, and the mesh is overlaid with a pattern of small, light-colored numbers (0-9) scattered across the surface.

# APPENDIX 1

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***FRYE/DAUBERT*—STATE-BY-STATE**

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State	Rule of Evidence	Standard
<b>Alabama</b>	Rule of Evidence 702	<p><i>Daubert</i> and <i>Frye</i>, depending on circumstances.</p> <p><i>See</i> Turner v. State, 746 So.2d 355 (Ala. 1998); Barber v. State, 952 So.2d 393 (Ala. Crim. App. 2005); ArvinMeritor, Inc. v. Johnson, 1 So.3d 77 (Ala. Civ. App. 2008); Mazda Motor Corporation v. Hurst, 261 So.3d 167 (Ala. 2017).</p>
<b>Alaska</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> State v. Coon, 974 P.2d 386 (Alaska 1999).</p>
<b>Arizona</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> State v. Tankersley, 956 P.2d 486 (Ariz. 1998); State v. Romero, 341 P.3d 493 (Ariz. Ct. App. 2014).</p>
<b>Arkansas</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> Farm Bureau Mut. Ins. Co. of Arkansas, Inc. v. Foote, 14 S.W.3d 512 (Ark. 2000); Coca-Cola Bottling Co. of Memphis, Tennessee v. Gill, 100 S.W.3d 715 (Ark. 2003).</p>

State	Rule of Evidence	Standard
<b>California</b>	Rule of Evidence 702	<p><i>Kelly/Frye</i></p> <p><i>See</i> People v. Kelly, 549 P.2d 1240 (Cal. 1976); People v. Venegas, 954 P.2d 525 (1998); <i>See also</i> Sargon Enterprises Inc. v. University of Southern California, 288 P.3d 1237 (Cal. 2012) (Recognizing the role of judges as gatekeepers and their ability to step outside the <i>Frye</i> standard, but declined to explicitly adopt the <i>Daubert</i> standard.).</p>
<b>Colorado</b>	Rule of Evidence 702	<p><i>Shreck/Daubert</i></p> <p><i>See</i> People v. Shreck, 22 P.3d 68 (Colo. 2001).</p>
<b>Connecticut</b>	Code of Evidence 7-2	<p><i>Porter/Daubert</i></p> <p><i>See</i> State v. Porter, 698 A.2d 793 (Conn. 1997).</p>
<b>District of Columbia</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> Murray v. Motorola, Inc., 982 A.2d 764 (D.C. 2009).</p>
<b>Delaware</b>	Uniform Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> Minner v. American Mortgage &amp; Guarantee Company 791 A.2d 826 (2000).</p>

State	Rule of Evidence	Standard
<b>Florida</b>	Fla. Stat. § 90.702	<i>Daubert</i>  <i>See</i> In Re: Amendments to the Florida Evidence Code, No. SC19-107 (Fl. May 23, 2019).
<b>Georgia</b>	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> HNTB Georgia, Inc. v. Hamilton-King, 697 S.E.2d 770 (Ga. 2010).
<b>Hawaii</b>	Rule of Evidence 702	<i>Frye</i>  <i>See</i> State v. Montalbo, 828 P.2d 1274, 1279-1280 (Haw. 1992) Reliability of scientific evidence depends on:  the validity of the underlying principle, and the proper application of the technique on the particular occasion . . . . Although general acceptance in the scientific field is highly probative of the reliability of a scientific procedure, there are other indicators of suitability for admission at trial.
<b>Idaho</b>	Rule of Evidence 702	<i>Daubert</i> (instructive) *  <i>See</i> State v. Merwin, 962 P.2d 1026 (Idaho 1998).



State	Rule of Evidence	Standard
Illinois	Rule of Evidence 702	<p><i>Frye</i></p> <p><i>See</i> Donaldson v. Cent. Illinois Pub. Serv. Co., 767 N.E.2d 314, 323 (Ill. 2002), <i>abrogated on other grounds</i> by In re Commitment of Simons, 821 N.E.2d 1184 (Ill. 2004):</p> <p>Illinois law is unequivocal: the exclusive test for the admission of expert testimony is governed by the standard first expressed in <i>Frye v. United States</i>, 293 F. 1013 (D.C.Cir.1923).;</p> <p>In re Commitment of Simons, 821 N.E.2d 1184, 1188 (Ill. 2004):</p> <p>In Illinois, the admission of expert testimony is governed by the standard first expressed in <i>Frye v. United States</i>, 293 F. 1013 (D.C. Cir. 1923).</p>
Indiana	Rule of Evidence 702	<p><i>Daubert</i> (instructive) *</p> <p><i>See</i> Alsheik v. Guerrero, 956 N.E.2d 1115, 1127 (Ind. Ct. App. 2011), <i>aff'd in part, vacated in part</i>, 979 N.E.2d 151 (Ind. 2012):</p> <p>Though we may consider the <i>Daubert</i> factors in determining reliability, there is no specific test or set of prongs which must be considered in order to satisfy Indiana Evidence Rule 702(b).</p>



State	Rule of Evidence	Standard
Iowa	Rule of Evidence 702	<p><i>Daubert</i> (instructive) *</p> <p><i>See</i> Leaf v. Goodyear Tire &amp; Rubber Co., 590 N.W.2d 525 (Iowa 1999):</p> <p>Trial courts are not required to apply the <i>Daubert</i> analysis in considering the admission of expert testimony . . . but may, in their discretion, consider the following factors if deemed helpful in a particular case: (1) whether the theory or technique is scientific knowledge that can and has been tested; (2) whether the theory or technique has been subjected to peer review or publication; (3) the known or potential rate of error; or (4) whether it is generally accepted within the relevant scientific community.</p> <p>(internal quotation omitted)**</p>
Kansas	Kansas Statute 60 – 456	<p><i>Daubert</i></p> <p><i>See</i> Smart v. BNSF Ry. Co., 369 P.3d 966 (Kan. Ct. App. 2016); City of Topeka v. Lauck, 401 P.3d 1064 (Kan. Ct. App. 2017), <i>review denied</i> (Apr. 26, 2018).</p>

State	Rule of Evidence	Standard
Kentucky	Rule of Evidence 702	<p><i>Daubert</i></p> <p>See <i>Miller v. Eldridge</i>, 146 S.W.3d 909, 913–14 (Ky. 2004):</p> <p>Under <i>Daubert</i>, the trial court functions as a ‘gatekeeper’ charged with keeping out unreliable, pseudoscientific evidence: [T]he trial judge must determine at the outset . . . whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails 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.</p>

State	Rule of Evidence	Standard
Louisiana	Rule of Evidence 702	<p><i>Daubert</i></p> <p>See State v. Foret, 628 So.2d 1116, 1123 (La. 1993):</p> <p>Since much of the Louisiana Code of Evidence is patterned after the Federal Rules of Evidence in an attempt to facilitate a ‘movement towards a uniform national law of evidence’, it seems appropriate for Louisiana courts to, “especially where the language of the Louisiana Code is identical or virtually identical with that used . . . in the federal rules” utilize this “body of persuasive authority which may be instructive in interpreting the Louisiana Code . . . As the Louisiana Code of Evidence provision on expert testimony is identical to the federal rule, it follows that this court should carefully consider the <i>Daubert</i> decision that soundly interprets an identical provision in the federal law of evidence.</p>

State	Rule of Evidence	Standard
Maine	Rule of Evidence 702	<p>Other (resembles <i>Daubert</i>)</p> <p><i>See</i> Searles v. Fleetwood Homes of Pennsylvania, Inc., 878 A.2d 509, 516 (Me. 2005); Tolliver v. Dep’t of Transp., 948 A.2d 1223, 1233 (Me. 2008):</p> <p>We have established a two-part test, originally articulated in <i>State v. Williams</i>, 388 A.2d 500, 504 (Me. 1978), for determining when expert testimony is admissible: ‘A proponent of expert testimony must establish that (1) the testimony is relevant pursuant to M.R. Evid. 401, and (2) it will assist the trier of fact in understanding the evidence or determining a fact in issue.’ Further, to meet the two-part test, ‘the testimony must also meet a threshold level of reliability.’ This is because ‘[i]f an expert’s methodology or science is unreliable, then the expert’s opinion has no probative value.’</p> <p>(internal quotation omitted) **</p>
Maryland	Rule of Evidence 702	<p><i>Reed/Frye</i></p> <p><i>See</i> Reed v. State, 391 A.2d 364 (Md. 1978).</p>

State	Rule of Evidence	Standard
Massachusetts	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> Commonwealth v. Lanigan, 641 N.E.2d 1342 (Mass. 1994).
Michigan	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> Gilbert v. Daimler Chrysler Corp., 685 N.W.2d 391, 408 (Mich. 2004).





State	Rule of Evidence	Standard
Minnesota	Rule of Evidence 702	<p><i>Mack/Frye</i></p> <p>See State v. Mack, 292 N.W.2d 764 (Minn. 1980); State v. MacLennan, 702 N.W.2d 219 (Minn. 2005):</p> <p>The proper standard to apply in assessing the admissibility of novel scientific evidence is the <i>Frye-Mack</i> standard. We recently reaffirmed our adherence to the <i>Frye-Mack</i> standard in <i>Goeb v. Tharaldson</i>, 615 N.W.2d 800, 813-14 (Minn.2000). Under the <i>Frye-Mack</i> standard, a novel scientific theory may be admitted if two requirements are satisfied. The district court must first determine whether the novel scientific evidence offered is generally accepted in the relevant scientific community. <i>Id.</i> Second, the court must determine whether the novel scientific evidence offered is shown to have foundational reliability.</p> <p>(internal quotation omitted) **</p>
Mississippi	Rule of Evidence 702	<p><i>Daubert</i></p> <p>See Miss. Transp. Comm’n v. McLemore, 863 So.2d 31 (Miss. 2003).</p>

State	Rule of Evidence	Standard
<b>Missouri</b>	Mo. Stat. § 490.065	<i>Daubert</i>  <i>See</i> State Bd. of Registration of Healing Arts v. McDonagh, 123 S.W.3d 146 (Mo. banc 2003).
<b>Montana</b>	Rule of Evidence 702	<i>Daubert</i> , only in certain circumstances  <i>See</i> State v. Moore, 885 P.2d 457 (Mont. 1994); State v. Damon, 119 P.3d 1194, 1198 (Mont. 2005):  We have held, however, that the district court's gatekeeper role established by <i>Daubert</i> applies only to the admission of novel scientific evidence in Montana.
<b>Nebraska</b>	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> Schafersman v. Agland Coop., 631 N.W.2d 862 (Neb. 2001).
<b>Nevada</b>	Nev. Stat. § 50.275	Other  <i>See</i> Higgs v. State, 222 P.3d 648 (Nev. 2010):  While Nevada's statute of admissibility tracks the language of its federal counterpart....we decline...to adopt the standard of admissibility set forth in <i>Daubert</i> .

State	Rule of Evidence	Standard
New Hampshire	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> Baker Valley Lumber, Inc. v. Ingersoll-Rand Co., 813 A.2d 409 (N.H. 2002).
New Jersey	Rule of Evidence 702	<i>Frye</i> or <i>Daubert</i> , depending on circumstances  <i>See</i> State v. Harvey, 699 A.2d 596, (N.J. 1997):  In criminal cases we continue to apply the general acceptance or <i>Frye</i> test for determining the scientific reliability of expert testimony.
New Mexico	Rule of Evidence 11-702	<i>Alberico/Daubert</i>  <i>See</i> State v. Alberico, 861 P.2d 192 (N.M. 1993).
New York	NYCPLR § 4515	<i>Frye</i>  <i>See</i> People v. Wesley, 633 N.E.2d 451 (N.Y. 1994).
North Carolina	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> State v. McGrady, 787 S.E.2d 1 (N.C. 2016).
North Dakota	Rule of Evidence 702	Other  <i>See</i> State v. Hernandez, 707 N.W.2d 449 (N.D. 2005).

State	Rule of Evidence	Standard
<b>Ohio</b>	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> State v. Thomas, 423 N.E.2d 137 (Ohio 1981); State v. Martens, 629 N.E.2d 462 (Ohio Ct. App. 1993).
<b>Oklahoma</b>	Okla. Stat. tit. 12 § 2702	<i>Daubert</i>  <i>See</i> Christian v. Gray, 65 P.3d 591 (Okla. 2003).
<b>Oregon</b>	Evidence Code 702	<i>Daubert</i>  <i>See</i> State v. O'Key, 899 P.2d 663 (Or. 1995).
<b>Pennsylvania</b>	Rule of Evidence 702	<i>Frye</i>  <i>See</i> Grady v. Frito-Lay, Inc. 839 A.2d 1038, 1047 (Pa. 2003).
<b>Rhode Island</b>	Rule of Evidence 702	<i>Daubert</i>  <i>See</i> In re Odell, 672 A.2d 457 (R.I. 1996).

State	Rule of Evidence	Standard
South Carolina	Rule of Evidence 702	<p><i>Jones</i></p> <p><i>See</i> State v. Jones, 259 S.E.2d 120 (S.C. 1979)</p> <p>In this case, we think admissibility depends upon . . . the degree to which the trier of fact must accept, on faith, scientific hypotheses not capable of proof or disproof in court and not even generally accepted outside the courtroom.</p> <p>(internal quotation omitted) **</p>
South Dakota	SDLRC 19-19-702	<p><i>Daubert</i></p> <p><i>See</i> State v. Hofer, 512 N.W.2d 482 (S.D. 1994).</p>
Tennessee	Rule of Evidence 702	<p><i>Daubert</i> (instructive) *</p> <p><i>See</i> McDaniel v. CSX Transp., Inc., 955 S.W.2d 257, 265 (Tenn. 1997).</p>
Texas	Rule of Evidence 702	<p><i>Daubert</i> (instructive) *</p> <p><i>See</i> E.I. du Pont de Nemours &amp; Co. v. Robinson, 923 S.W.2d 549 (Tex. 1995).</p>
Utah	Rule of Evidence 702	<p><i>Frye</i></p> <p><i>See</i> State v. Rinmasch, 775 P.2d 388 (Utah 1989); Alder v. Bayer Corp., AGFA Div., 61 P.3d 1068 (Utah 2002).</p>



State	Rule of Evidence	Standard
<b>Vermont</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> State v. Brooks, 643 A.2d 226, 229 (Vt. 1993):</p> <p>Similar principles should apply here because Vermont’s rules are essentially identical to the federal ones on admissibility of scientific evidence.</p>
<b>Virginia</b>	Rule of Evidence 702	<p><i>Daubert</i> (instructive) *</p> <p><i>See</i> John v. Im, 559 S.E.2d 694 (Va. 2002) (applicability of <i>Daubert</i> left open for interpretation).</p>
<b>Washington</b>	Rule of Evidence 702	<p><i>Frye</i></p> <p><i>See</i> State v. Riker, 869 P.2d 43 (Wash. 1994).</p>
<b>West Virginia</b>	Rule of Evidence 702	<p><i>Wilt/Daubert</i></p> <p><i>See</i> Wilt v. Buracker, 443 S.E.2d 196 (W. Va. 1994).</p>
<b>Wisconsin</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> In re Commitment of Alger, 858 N.W.2d 346 (Wis. 2015).</p>
<b>Wyoming</b>	Rule of Evidence 702	<p><i>Daubert</i></p> <p><i>See</i> Bunting v. Jamison, 984 P.2d 467 (Wyo. 1999).</p>

State	Rule of Evidence	Standard
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- \* “Instructive” means that *Daubert* is persuasive, and used by courts, but it is not necessarily binding or there is not a strict interpretation.
- \*\* “Internal quotation omitted” means that the quotation included quoted material from another case, but for the ease of reading, the quotation marks and citation(s) were removed. It indicates for the reader that if the person would like to see the quoted material that was omitted, the person can go to the case for that information.

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# APPENDIX 2

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## SAMPLE ORDERS FOR CRIMINAL DISCOVERY

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## APPENDIX #2

### LISTING OF SAMPLE ORDERS FOR CRIMINAL DISCOVERY

1. *DISCOVERY CONFERENCE, MEMORANDUM AND ORDER*—U.S. DISTRICT COURT—DISTRICT OF COLORADO
2. *SCHEDULING ORDER* - ELLIS COUNTY, TEXAS
3. *SCHEDULING ORDER*—U.S. DISTRICT COURT—WISCONSIN—WESTERN DISTRICT
4. *CRIMINAL TRIAL NOTICE AND SCHEDULING ORDER*—U.S. DISTRICT COURT—MICHIGAN—EASTERN DISTRICT (SOUTHERN DIVISION)
5. *SCHEDULING ORDER*—BERNALILLO COUNTY, NEW MEXICO





## 1. U.S. DISTRICT COURT—COLORADO DISTRICT

### IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLORADO

Criminal Action No.	)	
	)	JUDGE ASSIGNED:
UNITED STATES OF AMERICA,	)	
	)	ESTIMATED TRIAL
Plaintiff,	)	TIME:
	)	
v	)	NUMBER OF
	)	DEFENDANTS:
	)	
	)	DOCUMENT DISCLOSURE EXTENSIVE
Defendant.	)	<input type="radio"/> Yes <input type="radio"/> No
	)	(Please select one)
	)	

### DISCOVERY CONFERENCE MEMORANDUM AND ORDER

#### INTRODUCTION

Rule 16, Federal Rules of Criminal Procedure, is entitled Discovery and Inspection and provides for discovery by both defendant and the government. D.C.COLO.LCrR 17.1.1 requires a discovery conference memorandum and order be entered by a magistrate judge.

A defendant may discover certain material as a matter of right without any obligation to permit discovery by the government. However, if the defendant requests certain materials by discovery, namely, documents and tangible objects, as well as reports of examinations and tests, then the defendant is obligated to permit similar discovery by the government.

In addition to discovery we will take up the matter of notice, as required by Rules 12.1 and 12.2, Fed.R.Crim.P. if the defense of alibi or mental capacity is contemplated. Further, a date will be set for the filing of all motions.

At the conclusion of this hearing the report will be signed by defendant and/or his counsel, and government counsel, as well as the magistrate judge. The discovery hearing proceedings will be recorded.

**I. DEFENDANT'S REQUEST FOR DISCOVERY AND NOTICE**

(A) Request for Rule 16 Material

1. The defendant requests disclosure of the substance of any relevant oral statements made by the defendant, before or after arrest, in response to interrogation by any person the defendant knew to be a government agent if the government intends to use that statement at trial. Rule 16(a)(1)(A). The government states that it will disclose to the defendant and make available for inspection, copying, or photographing such statements in accordance with Rule 16(a)(1)(A).
2. The defendant requests disclosure of any relevant written or recorded statement made by the defendant within the government's possession, custody, or control, which the attorney for the government knows – or through due diligence could know – that the statement exists; the portion of any written record containing the substance of any relevant oral statement made before or after arrest if the defendant made the statement in response to interrogation by any person the defendant knew to be a government agent. Rule 16(a)(1)(B)(i) and (ii).
3. The defendant requests disclosure of any recorded testimony of the defendant before a grand jury which relates to the offense charged pursuant to Rule 16(a)(1)(B)(iii). The government states it will permit the defendant to inspect and copy such statements.
4. If government counsel knows of such statements he will so indicate by initialing here.

- 5 The defendant requests, if the defendant is an organization, the government's disclosure to the defendant of any statement described in Rule 16(a)(1)(A) and (B), if the government contends that the person making the statement; (i) was legally able to bind the defendant regarding the subject of the statement because of that person's position as the defendant's director, officer, employee, or agent; or (ii) was personally involved in the alleged conduct constituting the offense and was legally able to bind the defendant regarding that conduct because of that person's position as the defendant's director, officer, employee or agent. Rule 16(a)(1)(C).
- 6 The defendant requests a copy of his prior criminal record. The government states it will furnish to the defendant a copy of his prior criminal record, if any, in accordance with Rule 16(a)(1)(D).
- 7 The defendant, understanding his burden of reciprocal discovery as set forth in Rule 16(b)(1)(A), (requests) (does not request) disclosure of books, papers, documents, data, photographs, tangible objects, buildings or places, and copies or portions thereof, which are within the possession, custody, or control of the government, and which are material to the preparation of his defense, or are intended for use by the government as evidence in chief at the trial, or were obtained from or belong to the defendant.
- 8 The defendant, understanding his burden of reciprocal discovery as set forth in Rule 16(b)(1)(B), (requests) (does not request) disclosure of any results or reports of physical or mental examinations, and of scientific tests or experiments, or copies thereof, 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

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government, and which are material to the preparation of the defense or are intended for use by the government as evidence in chief at the trial.

9 The defendant, understanding his burden of reciprocal discovery as set forth in Rule 16(b)(1)(C), (requests) (does not request) disclosure of a written summary of testimony the government intends to use under Rule 702, 703, or 705 of the Federal Rules of Evidence, relating to expert testimony and opinions of experts, during its case in chief at trial, as set forth in Rule 16(a)(1)(G).

10 The government acknowledges its continuing duty to disclose under Rule 16(c).

(B) Request for Exculpatory Evidence

The defendant requests disclosure of evidence favorable to the defendant on the issue of guilt and/or sentencing. The government states it will disclose material evidence which is favorable to the defendant as required by Brady v. Maryland, 373 U.S. 83 (1963); Giglio v. United States, 405 U.S. 150 (1972); and United States v. Bagley, 473 U.S. 667 (1985). The government acknowledges its continuing duty to make these disclosures. This request does not foreclose the defendant from filing a more specific motion requesting exculpatory evidence.

(C) Evidence of Other

The defendant requests notice of other crimes, wrongs or acts under Rule 404(b) of the Federal Rules of Evidence. The government states that if it intends to introduce such evidence at trial it will provide written notice to the defendant no later than 21 days before trial unless, for good cause shown, the court permits less notice in accordance with Rule 404(b).



(D) Request for Disclosure of the Identity of Confidential Informants

1. The government states there (was) (was not) a confidential informant who was a participant in or a witness to the crime charged and that the informant (may) (will) (will not) be called as a witness at trial. The government further states it (has supplied) (will claim privilege of non-disclosure of) the identity of the confidential informant. Rovario v. United States, 353 U.S. 53 (1957).

## (E) The Government States There Have Been in this Case:

(Circle those which are applicable)

1. Telephone tape recordings;
2. Electronic surveillance of the defendant or his premises;
3. Leads obtained by electronic surveillance of defendant's person or premises; and
4. Photographic surveillance.

The government (may) (will) (will not) permit discovery of the foregoing items.

**II. GOVERNMENT'S REQUEST FOR DISCLOSURE AND NOTICE**(A) Request for Rule 16 Material

1. The government requests disclosure of books, papers, documents, data, photographs, tangible objects, or copies or portions thereof, which are within the possession, custody or control of the defendant and which the defendant intends to introduce as evidence in chief at the trial. If the defendant made a similar request under Rule 16(a)(1)(E), the defendant states that upon compliance by the government with the defendant's request he will permit the government to inspect and copy or photograph such items in accordance with Rule 16(b)(1)(A).

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2. The government requests disclosure of any results or reports of physical or mental examinations and of scientific tests or experiments made in connection with this case, or copies thereof, within the possession or control of the defendant as described in Rule 16(b)(1)(B). If the defendant made a similar request under Rule 16(a)(1)(F), the defendant states that upon compliance by the government with the defendant's request he will permit the government to inspect and copy or photograph such items in accordance with Rule 16(b)(1)(B).
- 3 The government requests disclosure of a written summary of testimony the defendant intends to use under Rules 702, 703 and 705, F.R.E. as evidence at trial. If the defendant made a similar request under Rule 16(a)(1)(G), the defendant states that upon compliance by the government with the defendant's request he will disclose such summaries in accordance with Rule 16(b)(1)(C).
- 4 The defendant acknowledges his continuing duty to disclose under Rule 16(c).

(B) Request for Notice of Alibi

- 1 The government hereby requests notice of the defendant's intent to rely on an alibi defense pursuant to Rule 12.1(a) of the Federal Rules of Criminal Procedure. The parties agree that the indictment/information and the discovery provided by the government give the defendant sufficient notice of the time, date, and place at which the alleged offense was committed and triggers the defendant's obligation under Rule 12(a) to serve upon the attorney for the government a written notice of alibi within 20 days from the date of this request, or at such different time as the court may direct. Should the defendant require additional information concerning the time, date, or place at which the alleged offense was committed, it is the defendant's obligation to file a request for additional information in the time provided for filing motions.

- 2 The government states that if the defendant files a notice of intent to rely upon alibi, the attorney for the government shall serve upon the defendant or the defendant's attorney a written notice stating the names and addresses of the witnesses upon whom the government intends to rely to establish the defendant's presence at the scene of the alleged offense and any other witnesses to be relied on to rebut the testimony of any of the defendant's alibi witnesses. The government's written notice shall be filed within 10 days of its receipt of the defendant's Rule 12.1(a) notice, but in no event less than 10 days before trial, unless the court otherwise directs.

- 3 The parties acknowledge their continuing duty to disclose under Rule 12.1(c).

(C) of Testimon  
Condition

The government hereby requests notice of the defendant's intent to rely on a defense based on insanity or to introduce expert testimony relating to mental condition. If the defendant intends to rely on the defense of insanity or introduce expert testimony relating to mental disease or defect or any other mental condition bearing on the issue of guilt, he agrees to file a written notice and disclosure of the same within 20 days from the date of this request, or at such different time as the court may direct.

### **III. LIKELIHOOD OF DISPOSITION OR TRIAL**

- (A) There is a (good) (fair) (poor) chance of a Rule 11 disposition of this case.
- (B) The parties understand that the court must be given notice of any proposed disposition no less than 10 days before the scheduled trial date. Unless otherwise ordered, notice of disposition shall be filed no later than 14 days before the date set forth for trial. (D.C.COLO LCrR 11.1A)

(Rev. 1/17/2019)

- (C) The defendant will receive a jury trial in accordance with F.R.Crim.P. 23(a). Waiver of jury can only be accomplished by filing a motion with the trial court.

**IV. SPEEDY TRIAL**

- (A) The speedy trial time limits of 18 U.S.C. § 3161 are as follows:

PNT period; 30 days

Trial clock; 70 days

Custody clock; 90 days

Date Signed

Defendant

Date Signed

Attorney for Defendant

Date Signed

Assistant United States Attorney

(Rev. 1/17/2019)



## V. DISCOVERY ORDER

### (A) Effect of Report

The responses by the parties set forth in this Report shall have the effect of a binding discovery order. All requests for discovery will be considered continuing requests, and any discoverable information and/or material coming into the possession or knowledge of either party prior to or during the trial shall be made available to the opposing party promptly, consistent with the law and on an ongoing basis.

### (B) U.S. Probation Office

Unless otherwise specified in this Discovery Order, at the time of the detention hearing or by [date], the U.S. Probation Office will disclose any criminal history information compiled on the defendant to both parties

### (C) Disclosure by the Government

Unless otherwise specified in this Discovery Order, the government on or before [date] shall disclose those materials that are on that date within the possession of the attorney for the government and are subject to disclosure under the provisions of Rule 16. If additional material subject to the disclosure obligations of Rule 16 come into the possession of the attorney for the government, the attorney for the government shall promptly disclose the material to the defendant. The attorney for the government shall exercise due diligence as expressly required by provisions of Rule 16 to fulfill his or her discovery obligations under the provisions of Rule 16.

Written summaries of any testimony that the government intends to use under Rules 702, 703, or 705, Fed. R.Crim P. 16(a)(1)(G) shall be provided on such schedule as the District Court shall determine upon motion by either party.

### (D) Disclosure by the Defendant

Unless otherwise specified in this Discovery Hearing Report, the defendant shall disclose its Rule

16 discovery material to counsel for the government on or before

Written summaries of any testimony that the defendant intends to use under Rules 702, 703, or 705, Fed.R.Crim P. 16(b)(1)(C) shall be provided on such schedule as the District Court shall determine upon motion by either party.

- (E) Any motion alleging a failure to comply with the time limits set forth in this report and order must be filed promptly.
- (F) Counsel is directed to obtain pretrial motion deadlines and a trial date from the presiding judge assigned to the case.

IT IS SO ORDERED

BY THE COURT

U.S. Magistrate Judge

Date

(Rev. 1/17/2019)



2. ELLIS COUNTY, TEXAS

NO.

Plaintiff(s),  
V.

Defendant(s).

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IN THE COUNTY COURT

AT LAW NO. 1

ELLIS COUNTY, TEXAS

**SCHEDULING ORDER**  
**With Pretrial Instructions**  
**& Final Pretrial Submission Form**

1. An initial blank and unsigned copy of this Scheduling Order is prepared by the Court in anticipation of a trial and is circulated to the parties shortly after filing of the first responsive pleading in the case. The parties should provide the Court Coordinator with requested trial dates (more and earlier dates are available for a trial to the Court than for a trial to a jury) and the Court shall select the date, taking into account the parties' requests and the Court's schedule. The completed and signed Scheduling Order that will govern this case will then be provided to the parties without the necessity of a scheduling hearing. If within six months of the initial responsive pleading filed in the case the parties have not requested a trial date, the Court may place this case on the DWOP docket or set this case for trial at its discretion.

2. The following instructions, pretrial schedule and form must be utilized and observed by the parties. No changes or modifications may be made except by written order of this Court.

a. **WRITTEN DISCOVERY:** Objections to written discovery must have a legally arguable basis in law and fact or must be warranted by a good faith argument for the extension, modification, or reversal of existing law. Written discovery must be supplemented promptly by the parties as new information and/or documents are received.

b. **EXPERT DISCOVERY:** The name, address, telephone number, occupation and area of expertise of each and every expert retained by the party to provide expert testimony or opinions at the trial of the case or whose work product, opinions or impressions have been reviewed by any testifying expert, must be disclosed and a report prepared and served upon each opposing counsel and non-represented party as required by the

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pertinent T.R.C.P. If any conflict exists between this Order and a statute or rule, the statute or rule will apply.

- c. **MEDIATION:** Mediation is required prior to a contested final hearing. Parties may submit an agreed written order designating their own mediator within thirty days of receipt of this Scheduling Order. If an agreed order is not submitted within that time frame, the case shall be mediated with a mediator appointed by the Court.
- d. **FINAL PRETRIAL SUBMISSION (FPTS):** Every party must file a Final Pretrial Submission either jointly or separately no later than 10:00 o'clock a.m. on the deadline indicated in this Scheduling Order.
- e. **FINAL PRE-TRIAL CONFERENCE (FPTC):** A Final Pretrial Conference will be held on this case at the time indicated in the Scheduling Order. The Attorney in charge for each party must be in attendance, unless expressly excused by the Court, with full authority to make decisions on behalf of the client. Matters to be considered and ruled upon by the Court are set forth hereafter in paragraph i.
- f. **JURY SELECTION & TRIAL:** Jury selection for jury cases will begin at the time indicated in the Scheduling Order. The Court anticipates no delays in the process since all pretrial matters will have been disposed of in the Final Pretrial Conference. The parties must assume that this case will go to trial and be first on the docket.
- g. **SETTINGS & HEARINGS:** The Court Coordinator sets hearings in consultation with the Court. By agreement of the parties and the Court, hearings can be eliminated and rulings made solely upon the written records.
- h. **ATTORNEY CONFERENCE REQUIRED:** Motions requesting a hearing may only be set after reasonable attempt to confer with opposing counsel and a filing of a certificate of conference attesting to the attempt to resolve the matter without action by the Court. The Court may set hearings at any time *sua sponte*.

**PRETRIAL PROCEEDINGS:** All evidentiary matters will be ruled upon by the Court at pretrial. At Final Pretrial Conference all contested matters not previously disposed of will be considered and ruled upon. At that time the Court will also determine which witnesses the Court will permit to testify and the legal theories under which the case will be tried. These rulings will include all known evidentiary conflicts for which there are objections and any and all other matters called to the attention of the Court such as the Motion in Limine described in paragraph j.

**MOTIONS IN LIMINE:** Abusive and detailed Motions in Limine that seek rulings on common evidentiary matters that are controlled by clear and undisputed rules of evidence will not be considered by the Court. However, to prevent prejudicial matters from being placed before the jury without proper foundation, the Court urges the parties

to file limine motions aimed at deterring prejudicial actions that are unique to their case so that pretrial rulings can be made.

- k. **AMENDMENTS TO SCHEDULING ORDER:** This Scheduling Order may not be changed except by Order of this Court.
- l. **TIME LIMITS:** The Court may impose reasonable time limits upon the parties in all proceedings; any such time limits will be announced to the parties prior to the commencement of any hearing and at the Final Pretrial Conference for the trial itself.
- m. **THE TEXAS LAWYER'S CREED:** The mandates for professionalism set forth in the Texas Lawyer's Creed and all other disciplinary rules must be observed by all attorneys practicing before this Court in default of which disciplinary action may result either within this Court or within the State Bar or Texas.
- n. **JUSTICE:** The Court will amend the terms of this Scheduling Order as may be necessary in order to prevent manifest injustice.
- o. **PRETRIAL DEADLINE DATES:** The schedule and deadlines for pretrial procedures are as follows:

ON OR BEFORE	MATTER TO COMPLETED
Date:	<b>I. JOINDER OF ALL PARTIES</b>
Date:	<b>II. EXPERTS DESIGNATED AND REPORTS FURNISHED</b>
Date	<b>III. DISCOVERY COMPLETE FINAL PLEADINGS FILED MOTIONS FOR SUMMARY JUDGMENT FILED</b>
Date:	<b>IV. MEDIATION DEADLINE</b>

Date: V FINAL PRETRIAL SUBMISSION (FPTS)  
FILED

Date: VI. OBJECTIONS TO EVIDENCE AND  
WITNESSES FILED

Date: VII. FINAL PRE-TRIAL CONFERENCE  
(FPTC)

Time: o'clock M.

Date VIII. TRIAL DATE (JURY OR TBC)

Time: o'clock M.

SIGNED AND ENTERED THIS THE OF 201

JUDGE PRESIDING





### 3. U.S. DISTRICT COURT—WISCONSIN—WESTERN

IN THE UNITED STATES DISTRICT COURT  
FOR THE WESTERN DISTRICT OF WISCONSIN

UNITED STATES OF AMERICA,

Plaintiff

SCHEDULING ORDER

v

18-cr-999-wmc

JOHN DOE,

Defendant.

At the November 30, 2018 arraignment, this court set the following schedule:

1) In response to the defendant's Rule 16 demand, the government will provide its required disclosures not later than December 7, 2018 and it has a continuing disclosure obligation throughout this case. The government and its agents are ordered to preserve rough notes and similar data compilations for possible disclosure later in this case. Pursuant to Rule 12, the government reports that it intends to use all disclosed evidence in its case-in-chief at trial.

2) Defendant must file and serve any pretrial motions and discovery requests not later than noon, January 11, 2019. Pursuant to 18 U.S.C. § 3161(h)(7), time from the arraignment until the deadline to file pretrial motions is excluded from the speedy trial clock regardless whether motions are filed. The ends of justice and the Sixth Amendment require that defendant and defense counsel receive adequate time to review the government's disclosures, investigate this case, then make tactical decisions whether to file motions and which motions to file. Briefs need not accompany motions. To obtain an evidentiary hearing on a motion, defendant must ask for it in the caption of each such motion and must submit admissible facts establishing a prima facie entitlement to the relief requested. *See U.S. v. Edgeworth*, 889 F.3d 350, 353-54 (7<sup>th</sup> Cir. 2018).



3) The pretrial motion hearing and any evidentiary hearing shall be January 18, 2019 at 9:00 a.m. The court will rule on each motion or set it for briefing in consultation with the parties. Unless the court is taking evidence on a dispositive motion, defendant may waive his presence at the preliminary pretrial conference.

4) Deadlines to disclose expert witnesses: Government: February 8, 2019

Defendant: February 22, 2019

5) Submissions for the final pretrial conference, namely proposed voir dire questions, jury instructions and motions in limine must be filed and served not later than March 5, 2019.

6) The final pretrial conference shall be March 7, 2019 at 1:00 p.m. Defendant may waive his presence at the final pretrial conference.

7) The final hearing before the trial judge shall be March 12, 2019 at 3:00 p.m. Defendant and trial counsel must attend this hearing.

8) Jury selection and trial shall begin March 18, 2019 at 9:00 a.m. The predicted trial length is one to two days. The parties are jointly responsible for alerting the clerk of court forthwith if a jury need not be called.

Entered this 30<sup>th</sup> day of November, 2018.

BY THE COURT

/s/

Magistrate Judge

## 4. U.S. DISTRICT COURT—MICHIGAN—EASTERN (SOUTHERN DIVISION)

UNITED STATES DISTRICT COURT  
EASTERN DISTRICT OF MICHIGAN  
SOUTHERN DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

Case No. 14-CR-XXXXX

v.

XXXXXXXXXX,

Defendant(s).

/

### CRIMINAL TRIAL NOTICE AND SCHEDULING ORDER

This Order is intended to eliminate unnecessary discovery motions and to expedite the presentation of evidence and the examination of witnesses. To the extent it is in conflict with any administrative order in this District, this Order shall govern.

#### YOU WILL RECEIVE NO FURTHER NOTICE OF THESE DATES

Pretrial Motions (except motions in limine) due:

Plea Cut-Off/Hearing (Signed Rule 11 Plea Agreement must be submitted to the Court two days prior)

Witness Lists, Proposed Voir Dire, Proposed Jury Instructions and Proposed Verdict Form (submitted directly to chambers) due:

Motions in Limine due

Final Pretrial Conference

Trial Date

#### ATTORNEY CONFERENCE AND DISCLOSURE

Within ten (10) days of the date of arraignment, government and defense counsel shall meet and confer for the purpose of resolving or minimizing the issues in controversy.

Upon the request of defense counsel, government counsel shall:

- (A) provide defense counsel with the information described in Federal Rule of Criminal Procedure 16(a)(1); and

(B) permit defense counsel to inspect and copy or photograph any exculpatory/impeachment evidence within the meaning of *Brady v. Maryland*, 373 U.S. 83 (1963), *United States v. Agurs*, 427 U.S. 97 (1976), and *Giglio v. United States*, 405 U.S. 150 (1972).

A list of such evidence shall be prepared and signed by all counsel. Copies of the items which have been disclosed shall be initialed or otherwise marked.

Nothing in this Order shall be construed to require the disclosure of *Jencks* Act (18 U.S.C. § 3500) material prior to the time that its disclosure is required by law. Nevertheless, the Court urges the government to disclose *Jencks* Act materials well in advance of trial. In the event that some materials are not disclosed sufficiently in advance of a government witness' testimony, the Court will allow a reasonable amount of additional time during trial for the defense to prepare before proceeding.

#### **DISCLOSURE DECLINED**

If, in the judgment of government counsel, it would be detrimental to the government's interests to make any of the disclosures set forth in the paragraph above, the government shall file a motion within the ten-day period seeking relief from this Order and setting forth the specific reasons therefore.

#### **CONTINUING DUTY**

The duty to disclose is continuing, even throughout trial

#### **DISCOVERY BY THE GOVERNMENT**

Nothing in these procedures is designed to preclude discovery by the government under the Federal Rules of Criminal Procedure, nor to alter the Defendant's obligation, if any, under Rule 16(b).

#### **E-FILING**

ALL attorneys must become familiar with the Court's Local Rules, including the ECF Policies and Procures.

Courtesy copies of appendices submitted in support of motions that have been e-filed must be furnished to chambers where: (1) exhibits contain materials that cannot be understood adequately in copied form (e.g., color photographs, color graphs and charts); (2) the appendix exceeds 50 pages in length; or (3) there are more than three exhibits. Courtesy copies should be sent by regular mail, posted within (1) business day of the e-filing date. Copies should be directed to chambers, not filed with the Clerk's Office. Exhibits submitted in support of a motion must be tabbed.



**PRE-TRIAL MOTIONS**Local Criminal Rule 12.1LR7.1

The deadline for filing pretrial motions is set forth in this Order

**EXHIBITS**

1. **Marking of Exhibits:** All exhibits must be marked in advance of trial using consecutive numbers (for the government) and letters (for the defendant).
2. **List of Exhibits:** A list of proposed exhibits shall be submitted directly to chambers by each of the parties by the deadline established in the Court's Criminal Trial Notice and Standing Order. However, no later than one (1) week before the Final Pretrial Conference, each party shall make available for inspection all exhibits which that party will introduce at trial. This provision shall not extend the time for disclosure and inspection of material previously ordered herein.
3. **Foundation Issues and Motions in Limine:** Motions in limine and any notices of intent to contest foundation, chain-of-custody, or scientific analysis shall be filed by the deadline for motions in limine, as set forth in the Court's Criminal Trial Notice and Standing Order. Any notice of intent to contest foundation, chain-of-custody, or scientific analysis shall set forth a good faith basis for the objection for each item or exhibit.

When defense counsel has inspected an exhibit which the government intends to introduce into evidence, the foundation for its receipt into evidence will be deemed established unless defense counsel files a notice with the Court at or before the Final Pretrial Conference that the foundation for admission into evidence of the exhibit will be contested.

4. **Objections to Exhibits:** This Order shall not affect the right of a party to object at the time of trial to the introduction of an exhibit other than on the basis of authentication and foundation.
5. **Custody and Record of Admitted Exhibits:** Counsel are required to maintain a record of all admitted exhibits during trial. Counsel for each party must keep custody of that party's admitted exhibits during trial. A party who objects to this provision must file a written objection prior to jury selection.
6. **Publication of Exhibits During Trial:** The Court encourages parties to use electronic projection to publish exhibits during trial in a manner that allows the



jury, court, attorneys, and parties to view the exhibit simultaneously. Parties are responsible for providing equipment for such purpose and should contact the Court's Case Manager, Richard Lory, to obtain permission to bring such equipment into the courthouse. If photographs and documentary exhibits are not published electronically, then the party must prepare exhibit books for the Court and each juror. Whether or not exhibits are published electronically, a separate exhibit book should be prepared and made available to a witness who is to be questioned about an exhibit.

- 7 **Preparing Exhibits For Jury Deliberation:** Counsel must confer and purge from one set of binders or files all exhibits not admitted during the course of trial. Originals of all exhibits admitted at trial should be ready to be turned over to the jury foreperson prior to closing jury instructions so that jury deliberations are not delayed.
- 8 **Filing Exhibits:** It is the responsibility of the parties to ensure that the record is complete. All trial exhibits, briefs, and proposed jury instructions are to be filed in the record within five business days of the verdict.
- 9 **Full Disclosure:** Computer generated visual or animated evidence, together with underlying data, must be disclosed to opposing counsel at least one week before the start of trial.
10. **Penalty:** A party who does not abide by these provisions may be subject to sanctions, including preclusion of the introduction of exhibits at trial by the offending party.

#### SCIENTIFIC ANALYSIS

When a defendant has been made aware of the existence of scientific analysis of an exhibit (which analysis has been determined by an expert in the relevant field of science), the results of the scientific analysis of the exhibit and the opinion of the scientist will be admitted into evidence unless the defendant files a notice with the Court prior to the Final Pretrial Conference, indicating that the scientific analysis of the exhibit will be contested. Such notice shall state whether the expert is desired as a witness.

#### WITNESS LIST

By the deadline established in the scheduling order, and to enable the Court to better estimate the length of trial, each party shall submit directly to chambers a list of witnesses by name and agency (if appropriate), whom the party reasonably anticipates it will call to testify at trial, noting the approximate amount of time it anticipates will be needed for examination of each such witness. This list should NOT be electronically filed or otherwise submitted to the Clerk's Office. All witnesses, including law enforcement personnel, are to testify in plain clothes.



### JURY INSTRUCTIONS

The parties must meet and confer prior to trial to discuss jury instructions. By the deadline established in this Order, the parties must submit directly to chambers a single set of proposed, stipulated jury instructions.

The Court has its own standard introductory and concluding instructions. Each party is responsible for submitting all instructions related to the specific charges or defenses, and special instructions relating to evidence. The Court will usually instruct the jury using the Sixth Circuit's pattern jury instructions when available.

All proposed instructions are to be submitted in typewritten form (double spaced) and on computer disk compatible with Microsoft Word 2010 or WordPerfect version X5. Each instruction shall contain references to authority (e.g., "Devitt and Blackmar, Section 11.08"), and shall be on a separate page. In addition, each party must submit separately to chambers all additional proposed instructions (in the same form) to which any other party objects. Nevertheless, the parties must make a concerted, good faith effort to narrow the areas of dispute and to discuss each instruction with a view to reaching agreement as to an acceptable form. The Court will resolve disputes at a hearing on the record.

The jury is charged before final argument.

### J. JURY SELECTION

The Court uses a "struck jury" system for jury selection. In most cases, the government is allowed 6 peremptory challenges and the defendant is allowed 10 peremptory challenges. The Court will select twelve regular and two alternate jurors. Alternate jurors are not told they are alternates; they are dismissed by random draw at the conclusion of the proofs.

Voir dire will be conducted by the Court. Counsel should submit proposed voir dire questions in writing by the deadline set forth in the scheduling order. Attorneys may present follow up questions at a sidebar conference and, when appropriate, the Court will ask the requested follow up questions, as provided by Fed. R. Crim. P. 24(a).

### K. NOTE-TAKING & JUROR INVOLVEMENT

Jurors will be allowed to take notes. The Court specifically instructs the jury in advance on this issue. Jurors who choose to take notes will be instructed that such notes are not themselves evidence, but are merely aids to the juror's memory of the evidence presented at trial. The Court will consider, on a case by case basis, whether jurors will be permitted to question witnesses, generally through submission of questions to be asked by the Court.

**L. MULTI-DEFENDANT OR MEGA TRIALS**

The Court does not have a general procedure for handling multi-defendant criminal "mega trials." For multi-defendant criminal trials the Court encourages attorneys to work out procedures for peremptory challenges among themselves. In such trials, if counsel cannot agree among themselves, the Court will allocate peremptory challenges depending on the circumstances of the case.

**M. CONTINUANCES**

Continuances of trial dates or continuances during trial will not be granted because of unavailability of witnesses. Please notify the Court if Court intervention is necessary to secure witness attendance. Otherwise, witnesses will be expected to be available when called.

**N. BENCH TRIALS**

Proposed findings of fact and conclusion of law must be submitted to chambers one week before the commencement of trial.

**O. FINAL PRETRIAL CONFERENCE**

At the Final Pretrial Conference, counsel must be prepared to discuss all matters that will promote a fair and expeditious trial, including but not limited to: (1) a potential summary of charges to be read to the jury; (2) anticipated evidentiary issues; (3) length of trial; (4) stipulations that may obviate the need for foundation witnesses; (5) stipulations that may obviate the need to prove facts that are uncontested; (6) stipulations that may obviate the need for certain exhibits; (7) peremptory challenges; and (8) special arrangements for the presentation of witnesses and other evidence (e.g., need for interpreters, A/V needs, etc.). The defendant(s) must be present at the conference.

U.S. DISTRICT JUDGE

## 5. BERNALILLO COUNTY, NEW MEXICO

STATE OF NEW MEXICO  
COUNTY OF BERNALILLO  
SECOND JUDICIAL DISTRICT COURT

No. CR [CR #]

STATE OF NEW MEXICO,

Plaintiff,

VS.

[DEFENDANT],

Defendant.

SCHEDULING      FOR TRACK      CASE      CALENDAR

THIS MATTER came before the Court for hearing on      The State appeared by  
and Defendant appeared personally, and  
through

This case has been assigned to Track

IT IS THEREFORE ORDERED:

1. The parties have a continuing duty to disclose and make available supplemental discovery within five (5) days of the receipt of such information.
2. All parties shall produce the results of any scientific evidence by
3. All witness interviews shall be completed by
4. All pretrial motions shall be filed
5. Pretrial motion responses shall be filed by      or within  
days of the filing of the original motion, whichever occurs sooner. Failure to file a response to a pretrial motion shall result in presumed concurrence in the original motion.
6. The pretrial evidentiary hearing (where requested) is scheduled  
Parties shall e-mail the appropriate TCAA at the time of filing their pretrial motion to confirm or cancel the evidentiary hearing.

7. All parties shall file notice with the court of any requirement for language access services by \_\_\_\_\_
8. The parties shall submit any plea agreement, in writing, to the Court by \_\_\_\_\_
9. The pretrial conference is scheduled for \_\_\_\_\_ . Defendant must be present for the final pretrial conference.
10. Parties shall file their final trial witness list \_\_\_\_\_
11. Trial is scheduled to commence \_\_\_\_\_ which is within [one hundred and eighty] [two hundred and seventy] [three hundred and sixty-five] days of the triggering event in this case.
12. Trial in this case is estimated to last \_\_\_\_\_ days. The parties shall notify the Court immediately if changes in the presentation of the case could impact the number of estimated days for trial.
13. Other \_\_\_\_\_

**The Court will not accept a plea agreement after the plea deadline.**

**The Court may impose abbreviated deadlines within this scheduling order.**

**Unless otherwise noted, the number of days is based on calendar days rather than business days.**

**If a party fails to comply with the dates outlined in the Scheduling Order, the Court shall impose sanctions. Sanctions may include, but are not limited to, dismissal with or without prejudice, suppression or exclusion of evidence, a monetary fine imposed upon a party's attorney, or a monetary fine imposed on the attorney's employing office with appropriate notice to the office and opportunity to be heard.**

**A fifteen (15) day extension of the time limits imposed by this order may be granted by the Court for good cause, so long as the extension would not result in an extension of the trial date. It shall not be assumed that substitution of counsel alone constitutes good cause for an extension of time.**

**IT IS SO ORDERED.**

**DISTRICT COURT JUDGE**



**STATE OF NEW MEXICO  
COUNTY OF BERNALILLO  
SECOND JUDICIAL DISTRICT COURT**

No. [CR #]

**STATE OF NEW MEXICO,**

**Plaintiff,**

**VS.**

**[DEFENDANT],**

**Defendant.**

**CERTIFICATION OF READINESS**

By filing this Certification of Readiness the State certifies to the Court it shall be fully ready for trial within the time limits found in LR2-400.

Counsel certifies this case has been investigated sufficiently to be reasonably certain that:

1. The case will reach a timely disposition by plea or trial within the case processing time limits set forth in this rule;
2. The Court will have sufficient information upon which to rely to assign this case to an appropriate track at the status hearing provided for in Paragraph G of LR2-400;
3. All discovery produced or relied upon in the investigation leading to the indictment or information has been provided to the defendant, and;
4. The State understands, absent extraordinary circumstances, the State's failure to comply with the case processing times set forth in LR2-400 will result in dismissal of the case.

Dated this \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

District Attorney's Office

Attorney's printed name



**STATE OF NEW MEXICO  
COUNTY OF BERNALILLO  
SECOND JUDICIAL DISTRICT COURT**

**No. CR [CR #]**

**STATE OF NEW MEXICO**

**Plaintiff,**

**VS.**

**[DEFENDANT],**

**Defendant.**

**MOTION TO IMPOSE SANCTIONS (NEW CALENDAR)**

Pursuant to Rule LR2-400, [Plaintiff] [Defendant] requests the Court impose sanctions for [Plaintiff's] [Defendant's] failure to follow the rules contained therein. [Plaintiff] [Defendant] alleges the following violation(s) of the Rule:

A request for hearing is filed concurrently to this Motion.

Dated this \_\_\_\_ day of \_\_\_\_\_ 20\_\_

Attorney for

Attorney's name printed



An abstract graphic featuring a teal wireframe mesh that forms a series of flowing, interconnected loops and curves. The background is dark, and the mesh is overlaid with faint, light-colored numbers (0-9) scattered across it.

# APPENDIX 3

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## BIOGRAPHIES

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## 1. EDITING AND DESIGN



**Hon. Peggy Hora, President, Justice Speakers Institute.** Judge Peggy Fulton Hora (Ret.) is the President of the Justice Speakers Institute, LLC. She retired from the California Superior Court after serving 21 years. She had a criminal assignment that included presiding over the Drug Treatment Court.

She is a former dean of the B.E. Witkin Judicial College of California and has been on the faculty of the National Judicial College (NJC) for over 25 years. She is the recipient of the 2017 V. Robert Payant Award for Teaching Excellence presented by the Faculty Council of the NJC.

Judge Hora was a Senior Judicial Fellow for the National Drug Court Institute and the Global Centre for Drug Treatment Courts.

Judge Hora is an international leader in the solution-focused courts movement and has written comprehensively on justice issues. The appellate court and almost 200 journals and law reviews have cited her work. She was a 2009-2010 Thinker in Residence appointed by the Premier of South Australia to study and make recommendations on the Australian justice system. She was a visiting scholar at the University of Tasmania School of Law.

Her international work includes speaking at conferences worldwide and hands-on training on drug courts and therapeutic jurisprudence in Israel, the United Kingdom, Argentina, Chile, Bermuda, South Africa, Italy, Pakistan, France, Japan, Russia, The Netherlands, Canada, Australia and New Zealand.

She is an Honorary President of the International Therapeutic Jurisprudence Society, a worldwide non-profit organization dedicated to advancing legal and interdisciplinary scholarship; identifying and promoting best professional practices; sponsoring conferences, workshops

and seminars; and, hosting and participating in print, electronic and social media platforms. A judicial award has been named for her by the Society.

She is a recipient of the Bernard S. Jefferson Judicial Education Award from the California Judges' Association and winner of the Rose Bird Award from California Women Lawyers. She was honored as Woman of the Year by the California legislature.



**Hon. Brian MacKenzie, Chief Financial Officer, Justice Speakers Institute.** Judge Brian MacKenzie (Ret.) is an award winning judicial educator who retired from the bench after almost 27 years of service. After leaving the bench he helped to create the Justice Speakers Institute where he is now a partner and Chief Financial Officer.

He has been honored by the Foundation for the Improvement of Justice with the Paul H. Chapman medal, for significant contributions to the American Criminal Justice System and by the American Judges Association for significant contributions to judicial education.

Judge MacKenzie served as the President of the American Judges Association from 2014 to 2015. From 2008 to 2010 Judge MacKenzie was the American Bar Association/National Highway Traffic Safety Administration Judicial Fellow. He received his Juris Doctorate from Wayne State University Law School in 1974.

Judge MacKenzie has written and lectured throughout the world on issues including procedural fairness, veterans treatment courts, domestic violence, drug treatment courts, alcohol and other drug testing, and high visibility cases. Among other entities he has presented for American University, the National Judicial College, the National Association of Drug Court Professionals, the American Judges Association, the American Bar Association, the National Highway Traffic Safety Administration, and the National Association of Court Managers. Recently, he was invited to observe the conference on the new treaty between the European Union and Turkey involving Syrian refugees, in Istanbul Turkey.



He is the co-editor of the book *Michigan Criminal Procedure*. He is also the author of the American Judges Association's position paper entitled "Procedural Fairness: The Key to Drug Treatment Courts."

Judge MacKenzie is married to Karen MacKenzie. He has three children; Kate, David and Breanna and five grandsons, Daniel, Raymond, Henry, Zachary and Lucas.



**Theodore Stalcup, Esq., Tomales, California.** Theodore, "Ted," Stalcup is a member of the California Bar Association, and is currently an attorney with the United States Social Security Administration, National Case Assistance Center. A graduate of the University of California at Berkeley, Mr. Stalcup moved to Paradise, Nevada to attend the William S. Boyd School of Law, clerking for the Honorable Peggy Fulton Hora (Ret.) at the Alameda County California Superior Court while he studied. After graduating Juris Doctor *cum laude*, Mr. Stalcup was hired to serve the Honorable Nancy Saitta as a law clerk in the Supreme Court of the State of Nevada. Returning to California, he worked in private criminal defense for 8 years, eventually running his own firm. He continued his work with Judge Hora, collaborating on his publications, which include *Drug Treatment Courts in the Twenty-first Century: The Evolution of the Revolution in Problem-solving Courts*, 42 GA L. REV. 717 (2008) and editing the chapter "Drug Courts" for the *Principles of Addiction Medicine* (4th Edition, 2009). Ted is in his 12th year volunteering for the Alameda County Bar Association's Lawyers in the Library program where he's assisted over 1,200 unrepresented parties with *pro bono* consultations on all areas of law including criminal, civil, family, and estate. He lives in Tomales, California, where he spends his spare time breeding and showing cats, hiking and enjoying the beauty of West Marin County.



**David J Wallace, J.D., Vice President, Justice Speakers Institute.** A pioneer in traffic safety, David Wallace developed the first TSRP (Traffic Safety Resource Prosecutor) program in Michigan becoming a national role model. As a TSRP, he facilitated a coordinated, multidisciplinary approach to the arrest and prosecution of impaired drivers and other traffic crimes as well as finding ways to respond to underage drinking.





In 2008, becoming the first Director of the National Center for DWI Courts (NCDC), Mr. Wallace oversaw a nationwide increase of 50% in the number of DWI Courts, changing repeat impaired drivers into law-abiding citizens. As the NCDC Director he trained new multi-jurisdictional teams on how to implement and operate an effective DWI Court; provided technical assistance to established DWI Courts; participated in national media events; lobbied national and state legislators to expand DWI Courts; and, collaborated with a broad range of stakeholders to implement and support these lifesaving programs.

With over 20 years in the courtroom as an assistant prosecutor, 7 years as a TSRP and 5 years as the Director of the NCDC, Mr. Wallace has worked with law enforcement officers, prosecutors, judges, probation officers, treatment professionals, highway safety advocates and others, bringing a complete perspective on what needs to be done in making communities safer.

Mr. Wallace is the recipient of the *Kevin E. Quinlan Award for Excellence* in Traffic Safety, the National Highway Traffic Safety Administration's *Public Safety Award*, and the *Jeff Sauter Treatment Court Award* from the Michigan Association of Treatment Court Professionals (MATCP). In 2020, he was elected Secretary of the MATCP.

As the Traffic Safety Guy, Mr. Wallace works to identify, develop and promote justice programs that improve public safety, reduce recidivism, and change lives. He is still active in the courtroom as a Chief Assistant Prosecuting Attorney in Michigan.

## 2. CONTRIBUTING AUTHORS



**Brian Abbott, Assistant Director, Hayden Planetarium, New York, New York.** Brian Abbott is the assistant director of the Hayden Planetarium at the American Museum of Natural History in New York City. He is an astrophysicist by training and commits himself to the communication of science to the public. He is the co-founder of the Digital Universe, a comprehensive, interactive atlas of the universe that spans the planets of the solar system to the farthest cosmic objects we see, billions of light years away. Mr. Abbott remains involved in science visualization, is the executive producer of *Skylight*, a video series showcasing astronomy and the night sky, and gives regular tours of the universe to the public. In his spare time, Mr. Abbott has a deep interest in photography, programming, web design, and rarely refuses an opportunity to travel or learn something new. *Photo by M. Shanley/©AMNH*



**Hon. Benes Z. Aldana, President & CEO, National Judicial College, Reno, Nevada.** Judge Benes Z. Aldana (Ret.) became the ninth president of The National Judicial College on May 1, 2017. Before joining the NJC, he was on active duty in the U.S. Coast Guard for over 22 years, retiring in the rank of captain and serving as chief trial judge during his last tour of duty. Prior to this assignment, he served as the chief legal officer for the 8th Coast Guard District in New Orleans, Louisiana, overseeing legal advice to Coast Guard operations spanning 26 states and the Gulf of Mexico. He was first appointed a military trial judge in 2005 and as an appellate judge in 2015. Other notable assignments as a Coast Guard judge advocate included: chief counsel, Legal Engagements Division, U.S. Africa Command in Stuttgart, Germany; deputy staff judge advocate, 13th Coast Guard District; special assistant U.S. attorney for the Western District of Washington; trial attorney at the Department of Justice, Environment and Natural Resources Division; legal advisor to the Department of Defense Criminal Investigation Task Force, Guantanamo Bay, Cuba; deputy chief, Office of Environmental Law, U.S. Coast Guard; and appellate and trial counsel. He also served as the commanding officer, personnel services and support unit, Seattle, and executive officer for

Coast Guard Base Seattle. He is also a dedicated bar association leader and served as 2009 president of the Asian Bar Association of Washington. Although he grew up in the Seattle area, graduating from Seattle University and University of Washington School of Law, his career has taken him around the world. Among his many other achievements and accomplishments, he served as 2012-2013 chair of the American Bar Association Solo, Small Firm, and General Practice Division, which has approximately 20,000 members and is one of the largest entities in the ABA. He also served in the ABA House of Delegates and on the ABA Rule of Law Initiative Board, ABA Standing Committee on Judicial Independence, ABA Commission on Diversity and Inclusion 360, and as the assembly speaker of the ABA Young Lawyers Division. He recently concluded his service as a member of the ABA Law and National Security Advisory Committee. His military awards include the Defense Meritorious Service Medal, two Coast Guard Meritorious Service Medals, four Coast Guard Commendation Medals, the Army Commendation Medal, two Coast Guard Achievement Medals, and two Commandant's Letters of Commendation, as well as various team and unit awards. Non-military awards include the DHS General Counsel's Award of Excellence, the NAPABA Daniel Inouye Trailblazer Award, ABAW Judge of the Year, ABA Outstanding Young Military Lawyer Award, NAPABA's "Best Lawyer Under 40," and the American Bar Foundation Fellows Outstanding Chair Award.



**Hon. Kevin Burke, District Judge, Hennepin County, Minnesota.**

Judge Kevin Burke (Ret.) was a District Judge in Hennepin County, Minnesota. He is one of the most recognized leaders within the American judiciary. Judge Burke was elected for four terms as Chief Judge and three terms as Assistant Chief Judge. During this time he instituted social science studies—and reforms improving—procedural fairness. From 1991–1996 he served as the Chair of the Conference of Chief Judges. He chaired the State Board of Public Defense, and was a leader in the effort to improve and expand the state's public defender system.

Judge Burke has been named one of the 100 most influential lawyers in the history of Minnesota by Law & Politics magazine. In 1996 he

was named a Toll Fellow. The Toll Fellowship identifies emerging state leaders from all three branches of government. In 1997 he received the Director's Community Leadership Award from the Federal Bureau of Investigation. In 2002 the National Center for State Courts awarded him the Distinguished Service Award. In 2003 he was selected as the William H. Rehnquist Award recipient by the National Center for State Courts. The Rehnquist Award is presented annually to a state judge who exemplifies the highest level of judicial excellence, integrity, fairness and professional ethics. He was awarded Public Official of the Year by Governing Magazine in 2004. In 2005 the Minnesota Chapter of the American Board of Trial Advocates named him Trial Judge of the Year. The American Bar Association named him Judicial Educator of the year in 2010.

Judge Burke teaches at the University of Minnesota and University of St. Thomas law schools. For many years he served on the faculty of the University of Minnesota Humphrey Institute's Reflective Leadership Program. He has been a speaker in 38 states as well as Abu Dhabi, Canada, Egypt, Mexico, China, India and Ireland regarding improvement in judicial administration and court leadership.

Judge Burke has authored numerous articles, and is the co-author of two American Judges Association White Papers, "Procedural Fairness: A Key Ingredient in Public Satisfaction" and "Minding the Court: Enhancing the Decision-Making Process." He presently serves on the Board of the Institute for the Reform of the American Legal System. He is a past Board member of the National Center for State Courts and the American Judicature Society. Judge Burke is an Associate of the Justice Speakers Institute, LLC.



**Eryn Blagg, Doctoral Student, Department of Statistics, Iowa State University.** Eryn Blagg graduated from Lawrence University in Appleton WI in 2018 with a BA with a double major in Mathematics and Studio Art, and became a member of Phi Beta Kappa. She then went to Iowa State University, in Ames Iowa where finished her MS in Statistics in 2020 and is currently pursuing on her PhD in the same field. Her main





area of research is in forensic statistics where she works with the Center for Statistics and Applications in Forensic Evidence (CSAFE), a federally funded research center, on statistical outreach for the legal community and statistical applications applied to pattern evidence. She also teaches introductory statistics at Iowa State, for undergraduates, and was awarded a teaching excellence award in 2020.



**Hon. Louis B. Butler, Jr. Justice, Supreme Court, Milwaukee, Wisconsin.** Justice Louis Butler (Ret.) was appointed to the Wisconsin Supreme Court by Governor Jim Doyle in August 2004, becoming the first African-American Supreme Court Justice in Wisconsin. His term ended July 31, 2008. He is currently a partner at DeWitt, LLP. He previously served on the faculty at the University of Wisconsin Law School, where he taught Selected Problems in Constitutional Law, 4th, 5th and 6th Amendments, as well as Appellate Advocacy. He earned a Bachelor's degree from Lawrence University in Appleton and Juris Doctor from the University of Wisconsin Law School. He also received an Honorary Doctorate in Humanities from Lawrence in 2007. He previously served on Wisconsin's Criminal Benchbook Committee. He was most recently invited to join the American Academy of Appellate Lawyers as an Honorary Fellow in 2018. Justice Butler is an alumnus of The National Judicial College and joined its faculty in 1997.



**Alicia Carriquiry, Ph. D, Distinguished Professor of Statistics, Iowa State University.** Alicia Carriquiry was born in Montevideo, Uruguay. She received the degree of Ingeniero Agrónomo from the Universidad de la República in 1982. She enrolled in a MSc degree in animal breeding at the University of Illinois in Urbana, and graduated in 1985. She then moved to Iowa State University in Ames, where she obtained an MSc in Statistics in 1986 and completed a joint PhD in statistics and animal genetics in 1989.

Since 1990, Carriquiry has been on the faculty in the Department of Statistics at Iowa State University. She is currently Distinguished Professor of Liberal Arts and Sciences, holds the President's Chair in Statistics, and is Director of the Center for Statistics and Applications



in Forensic Evidence (CSAFE), a federally funded research center. She is an Elected Member of the National Academy of Medicine, a Fellow of the American Statistical Association, a Fellow of the Institute of Mathematical Statistics, a Fellow of the International Society for Bayesian Analysis, a Fellow of the American Association for the Advancement of Science, and an elected member of the International Statistical Institute. Carriquiry was named Technical Advisor for the Association of Firearm and Toolmark Examiners in 2018 and was elected to the American Academy of Forensic Sciences as an Associate Member in 2020. Her research interests include measurement error modeling, survey sampling and Bayesian methods. In recent years, she has become interested in statistical learning algorithms and their application in various disciplines, in particular in forensic science and criminal justice.



**Hon. Ming Chin, Associate Justice, Supreme Court, San Francisco, California.** Justice Ming W. Chin (Ret.) was appointed to the California Supreme Court in March 1996. Before being named to the high court, Justice Chin served from 1990 to 1996 on the First District Court of Appeal. Prior to his Court of Appeal appointment, Justice Chin served on the bench of the Alameda County Superior Court. Justice Chin began his legal career as a prosecutor in the Alameda County District Attorney's office and later was a partner in an Oakland law firm specializing in business and commercial litigation.

Justice Chin is the Vice Chair of the California Judicial Council and has chaired the Council's Commission for Impartial Courts, Court Technology Advisory Committee, and Science and the Law Steering Committee. The Judicial Council named him California Jurist of the Year for 2009. Justice Chin is an author of two Rutter California Practice Guides: Employment Litigation and Forensic DNA Evidence: Science and the Law.



**Christine Funk, J.D., Attorney, St. Paul, Minnesota.** Christine Funk started her career in the Minnesota Office of the Public Defender in 1994. In 1995, she was assigned her first forensic DNA case. Not a scientist by training, she struggled to understand the complexities of forensic evidence. Over the years, her forensic caseload expanded to include



arson, broken babies, drug chemistry, forensic biology, bite marks, as well as the study of false confessions and eyewitness identification in the context of complex litigation.

In 2013, Funk moved to Washington, DC to become General Counsel for the Department of Forensic Sciences. This provided additional insights as to how forensic science fits within the criminal justice system.

In 2017, Funk returned to Minnesota, where she writes about issues pertaining to the law and forensic science, provides representation to indigent clients, and consults with criminal justice stakeholders, as well as those writing about forensic science – from investigative pieces to movie scripts to a television pilot.

Previously, Ms. Funk has served on the Legal Resource Committee for the Organization of Scientific Area Committees, the Board of the Minnesota Innocence Project, the Forensic Laboratory Advisory Board for the state of Minnesota, and the White House Sub-Committee to the Sub-Committee on Forensic Science in Education, Ethics, and Terminology.



**Hon. Veronica Alicea-Galván, Judge Superior Court, King County, Washington.** Judge Veronica Alicea-Galván is a 1994 University of Washington School of Law graduate. She has served as an Assistant City Attorney for the City of Seattle, and also served the City of Federal Way in this same capacity. Judge Alicea-Galván took the bench in 2001 as a Judge Pro Tempore, and was appointed to a full time judicial position as an Administrative Law Judge in 2002. In 2007, Judge Alicea-Galván was appointed to the Des Moines Municipal Court where she served with distinction, earning the Juez Excepcional award from the Latina/o Bar Association of Washington. Governor Jay Inslee appointed Judge Alicea-Galván to the King County Superior Court in December of 2014. While in Des Moines, Judge Alicea-Galván implemented the only Spanish-language Court in the state of Washington granting hundreds of litigants the opportunity to address the court directly in Spanish. She was recognized by her alma mater with the Dean’s Leadership Award in

2015, in 2016 she was recognized as a Woman of the Year by the Center for Women & Democracy, and in 2018 earned the Vanguard Award from Washington Women Lawyers. In addition to her judicial duties, Judge Alicea-Galván is a faculty member for the Washington State Judicial College where she has taught several courses, most recently, Emerging Through Bias: Towards A More Fair And Equitable Courtroom. Judge Alicea-Galván is also an adjunct instructor at Seattle University School of Law and has lectured extensively at legal education programs.



**Hon. Cindy Lederman, Judge, Dependency Court, Dade County, Florida.** Judge Cindy S. Lederman (Ret.) served in the Miami-Dade Juvenile Court 1994 to 2018, including 10 years as the court's Presiding Judge. Elected to the Miami-Dade County Court in 1988, before her elevation to Circuit Court in 1994, she was a leader of the team that created the Dade County Domestic Violence Court and served as the court's first Presiding Judge. Judge Lederman's interest in bringing science and research into the courtroom results from her involvement with the National Research Council and Institute of Medicine at the National Academy of Sciences for more than 10 years Judge Lederman was a member of the National Research Council's Committee on Family Violence Interventions and Panel on Juvenile Crime, Treatment and Control and has served from 1996 to 2004 on the Board of Children, Youth and Families of the National Research Council and Institute of Medicine. In 1999, Judge Lederman was awarded a Fellowship from Zero to Three: The National Center for Infants, Toddlers and Families in their Leaders of the 21st Century Initiative. The Council of State Governments has awarded Judge Lederman a 2002 Toll Fellowship. Judge Lederman was a member of the Board of Trustees of the National Council of Juvenile and Family Court Judges and former President of the National Association of Women Judges. Judge Lederman served on the American Academy of Pediatrics Task Force. Judge Lederman's book is entitled "Child-Centered Practices for the Court and Community" published by Brookes in 2011. Judge Lederman was named the Judge of the Year by National CASA in 2014 and was the recipient of the 2018 Janet Reno Endowment Women's Leadership Award from the Georgetown University McCourt School of Public Policy.





**Hon. Brian MacKenzie, Chief Financial Officer, Justice Speakers Institute.** Judge Brian MacKenzie (Ret.) is an award winning judicial educator who retired from the bench after almost 27 years of service. After leaving the bench he helped to create the Justice Speakers Institute where he is now a partner and Chief Financial Officer.

He has been honored by the Foundation for the Improvement of Justice with the Paul H. Chapman medal, for significant contributions to the American Criminal Justice System and by the American Judges Association for significant contributions to judicial education.

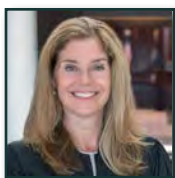
Judge MacKenzie served as the President of the American Judges Association from 2014 to 2015. From 2008 to 2010 Judge MacKenzie was the American Bar Association/National Highway Traffic Safety Administration Judicial Fellow. He received his Juris Doctorate from Wayne State University Law School in 1974.

Judge MacKenzie has written and lectured throughout the world on issues including procedural fairness, veterans treatment courts, domestic violence, drug treatment courts, alcohol and other drug testing, and high visibility cases. Among other entities he has presented for American University, the National Judicial College, the National Association of Drug Court Professionals, the American Judges Association, the American Bar Association, the National Highway Traffic Safety Administration, and the National Association of Court Managers. Recently, he was invited to observe the conference on the new treaty between the European Union and Turkey involving Syrian refugees, in Istanbul Turkey.

He is the co-editor of the book *Michigan Criminal Procedure*. He is also the author of the American Judges Association's position paper entitled "Procedural Fairness: The Key to Drug Treatment Courts."

Judge MacKenzie is married to Karen MacKenzie. He has three children; Kate, David and Breanna and five grandsons, Daniel, Raymond, Henry, Zachary and Lucas.



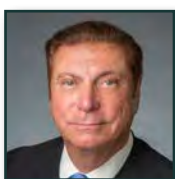


**Hon. Bridget Mary McCormack, Chief Justice, Supreme Court, Lansing, Michigan.** Chief Justice Bridget Mary McCormack joined the Michigan Supreme Court in January 2013, and became the Chief Justice in January 2019.

An NYU Law graduate, Chief Justice McCormack started her legal career in New York City. In 1996 she joined the Yale Law School faculty. She then joined the University of Michigan Law School faculty, in 1998, where she taught criminal law, legal ethics, and various clinics. She was named Associate Dean for Clinical Affairs in 2002.

Chief Justice McCormack was elected to The American Law Institute in 2013. The U.S. Department of Justice and the U.S. Department of Commerce's National Institute of Standards and Technology appointed her to the National Commission on Forensic Science in 2014. She serves as an editor on the ABA's preeminent journal, *Litigation*, and as a member of the National Conference of Bar Examiners Torts Drafting Committee. And she continues to teach at the University of Michigan each year as well as publish in professional journals and law media.

Chief Justice McCormack is married to Steven Croley, a partner at Latham and Watkins. They have four children.



**Hon. Joseph J. Maltese, J.D., Ph.D., Associate Justice, Supreme Court, Appellate Division, 2<sup>nd</sup> Department, Staten Island, New York.** Justice Joseph J. Maltese is an Associate Justice of the New York Supreme Court Appellate Division, Second Department. Justice Maltese previously presided in the New York Supreme Court handling medical malpractice, product liability, mass torts, commercial, civil, criminal and matrimonial matters. Prior to serving in the New York Supreme Court, he sat in the New York City Civil Court and the New York City Criminal Court. He also serves as the Presiding Justice and formerly as an Associate Justice on the New York State Litigation Coordinating Panel, which oversees complex litigation pending in more than one county of New York. Justice Maltese also sits on the Judicial Advisory Panel.



Before coming to the bench, Justice Maltese was an attorney in the private practice of law concentrating in civil and criminal litigation in New York and New Jersey. He served as a law clerk to a judge and is a member of the bars of New York, New Jersey and Florida, as well as the federal courts.

Justice Maltese is an Adjunct Professor of Law at New York Law School, where he teaches product liability and mass torts. He also teaches courses on scientific evidence to judges at the National Judicial College and at the New York State Judicial Institute. He is a Fellow of the Advanced Science & Technology Adjudication Resource (ASTAR) Program and a Fellow of The American Academy of Forensic Sciences where he was the Chair of the Jurisprudence Section. Justice Maltese serves on the Editorial Board of the Bench Book for Trial Judges of New York published by West Publishing. He was also a Co-Editor of the Resource Guide for Managing Complex Litigation published by the National Judicial College.

Justice Maltese has a Doctor of Philosophy and a Master of Judicial Studies degree from the University of Nevada at Reno, as well as a Master of Arts in International Relations and American Politics from New York University, a Master of Science in Forensic Examination degree from Touro College, a Juris Doctor from New York Law School and a Bachelor of Arts from the John Jay College of Criminal Justice of the City University of New York. He is a member of The Honor Society of Phi Kappa Phi.

Joseph Maltese is a retired Brigadier General of the New York Guard. He retired from the U.S. Army Reserve, with over thirty years of combined active and reserve service. During his last seven years of duty, he served as a Military Judge for the U.S. Army Trial Judiciary presiding over active duty courts-martial in Germany, Panama and at several military installations in the United States. He previously served as a JAG Officer in the Judge Advocate General's Corps and as an Armor Officer in various assignments on active and reserve duty.



**Marc Picker, J.D. Alternate Public Defender, Washoe County, Nevada.** Marc Picker is a criminal defense attorney with 31 years of experience representing clients accused of everything from traffic citations to first degree murder. He is currently the Alternate Public Defender for the Washoe County, Nevada, where he supervises criminal defense and specialty/therapeutic court attorneys while at the same time carrying a full docket of serious criminal cases. He is a 1988 graduate of the UC Davis King Hall School of Law and was previously in private practice for 25 years concentrating on criminal defense, civil litigation, contracts law and personal injury. He has taught continuing legal education courses in a variety of areas, and now provides training through the National Judicial College for trial and limited jurisdiction judges throughout the United States on subjects related to driving while impaired, driving under the influence of alcohol or other drugs and forensic science in criminal justice. He is active in providing constitutional law education through his volunteer position coordinating classes and competition in northern Nevada for We the People: The Citizen and the Constitution. Prior to attending law school, he was an award winning newspaper reporter and editor. He is a graduate of the University of Nevada with a Bachelor of Arts in Journalism Degree. Mr. Picker is an Associate of the Justice Speakers Institute, LLC.



**Hon. Samuel A. Thumma, Chief Judge, Division One, Court of Appeals, Arizona.** Chief Judge Samuel Thumma served from 2007-2012 as a trial judge on the Arizona Superior Court. Judge Thumma is a Uniform Law Commissioner; Advisor, ALI's RESTATEMENT OF THE LAW (THIRD) OF TORTS: LIABILITY FOR ECONOMIC HARM; Secretary, ABA's Judicial Division Appellate Judges Conference; and Co-Chair, ABA Judges' Journal Editorial Board. He is Co-Chair, Arizona Supreme Court's Committee on the Rules of Evidence; Chair, Judicial Ethics Advisory Committee; and Co-Editor, ARIZONA APPELLATE HANDBOOK. He has presented at more than 300 seminars and published 12 law review and 50 other law-related articles. Judge Thumma was a partner at Perkins Coie Brown & Bain, Phoenix; an associate at Arnold & Porter, Washington, D.C., and a law clerk, Arizona Supreme Court Chief



Justice Stanley G. Feldman and Judge David R. Hansen, U.S.D.C. N.D. Iowa. He graduated Order of the Coif, University of Iowa College of Law (1988) and from Iowa State University (1984), where he was a Truman Scholar.