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California Expert Witnesses

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The life of the law has not been logic: it has been experience.
O.W. Holmes, Jr., THE COMMON LAW (1881).

Introduction

Media are replete with speculation, accusations of fake news, rumors, astounding discoveries and wild claims about products, people and companies--some of which might be true. Or not. Many commonly accepted theories and notions have no basis. "The Death Of Expertise," a book's title notes,[1] chronicling a rejection of objective fact and "wave of anti-rationalism that has been accelerating for years — manifested in the growing ascendance of emotion over reason in public debates, the blurring of lines among fact and opinion and lies, and denialism in the face of scientific findings about climate change and vaccination."[2]

Courts are the one place in our communities where we insist on provable facts. We have rules of evidence, meant to guard against the unproven, the unknown, and the just made-up.

A significant portion of those rules relate to expert witnesses. Courts value expertise.

Cases increasingly rely on experts. A Rand study found that 86 percent of California civil trials involved expert testimony, with at least three experts on average testifying in every trial.[3] And when these experts testify at trial, they are often decisive. On pretrial motions such as summary judgment and class certification, experts are as crucial. Many cases require an expert—without one, the party is doomed. Great care is required in the use of experts, both procedurally and with attention to the substantive grounds for expert admissibility.

This guide addresses civil litigation, with no special attention to criminal, family, or juvenile courts. It first addresses the two areas of procedure and substantive admissibility. Then the guide focuses on two

[1] Tom Nichols, THE DEATH OF EXPERTISE: THE CAMPAIGN AGAINST ESTABLISHED KNOWLEDGE AND WHY IT MATTERS (2017).
[2] Michiko Kakutani's review of *The Death Of Expertise*, New York Times March 22, 2017, Section C, Page 1, https://www.nytimes.com/2017/03/21/books/the-death-of-expertise-explores-how-ignorance-became-a-virtue.html. On the same theme, see e.g., Michael Shermer, WHY PEOPLE BELIEVE WEIRD THINGS (2002); Shawn Otto, THE WAR ON SCIENCE (2016).
[3] https://courtroominsight.wordpress.com/2012/12/10/high-court-changes-evidentiary-standard/

of the most important recent cases on experts and associated issues: *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747 (2012) and *People v. Sanchez,* 63 Cal.4th 665 (2016).

The next section is motivated by a core problem with experts. The central conundrum of testifying experts is this: they may only testify when laypeople (e.g., the judge and the jury) don't know what the expert knows; but judges and juries are expected to decide if the expert is right or not. In the case of judges, they are to determine if the opinion is reliable and has an adequate foundation; juries decide how much weight to give to the opinion, and may choose between opposing expert opinions. Judges do not "resolve scientific controversies," *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747, 772 (2012), but that means that juries *do.* But as among the experts, jurors, lawyers, parties, and the judge, it is the jury which has the *least* access to the studies and reports which might show the merits of the scientific controversy. This peculiarity in the law points to deep unresolved problems in the rules governing the admissibility of expert testimony, and some considerable space in this guide is devoted to it under the rubric of "The *Cooper* Problem: The Use of Reports and Studies."

The systems of procedural and substantive requirements for expert testimony are designed to ensure only reliable evidence is heard by the jury. The consequences when these systems go awry are devastating. As I note in a later section on pattern evidence (fingerprints, hair samples, tire tracks etc.) a long history of rote admission of the evidence (accepted by courts likely because much of the evidence was provided by one of the most widely respected and reputable group of forensic investigators, the FBI) led to terrible abuses and erroneous convictions.

The truth is that a lot of 'expert' opinion is unsubstantiated. It just sounds authoritative. The central problem is that it's never been exposed to experience—and it is experience, I suggest, which is the touchstone of authoritative expert opinion. Expertise is the summary of experience. The expert personally may have the experience: the pilot, the plumber, police officer, the architect with a dozen buildings on her resume—all these will testify with the authority of experience. Other experts will review studies, select those which truly stand up to the requirements of scientific rigor, and testify on what experience (in the form of experiments) has shown. We might trust them. But we must be on very high alert when the soi-disant expert has no experience to report, when her results have never been tested against reality.

This guide addresses expert issues that seem to me to be important; it is not comprehensive. For example, it lists, but has no detail on, the sorts of motions that one might bring to augment and substitute expert witness disclosures. The resources listed after this Introduction should be consulted.

This guide is not just a dry recitation of the law, although most of section 1, on procedure, is mostly that. Experts are about experience, and I have cited newspaper articles, books, and many websites to give life to what otherwise would be abstract, and so only marginally useful, discussions. I have also tried to separate out my personal views from my understanding of the state of the law, perhaps not always successfully, by walling off most of my opinions under the rubric of a "Comment". But many gaps and errors remain in the text, I am sure, and I would be grateful for kind corrections and suggestions. This guide is updated from time to time, and I suggest readers check for the current version at https://works.bepress.com/curtis_karnow/39/.

Undesignated code sections such as "2034.470(a)" refer to the Code of Civil Procedure.

Core Resources

- Weil & Brown, et al., CALIFORNIA PRACTICE GUIDE: CIVIL PROCEDURE BEFORE TRIAL ¶ 8:1624 *ff*. (Rutter)
- CALIFORNIA JUDGES BENCHBOOK: CIVIL PROCEEDINGS, DISCOVERY Ch. 23 (2021)
- CALIFORNIA JUDGES BENCHBOOK: CIVIL PROCEEDINGS, TRIAL §§ 8.76 *ff*. (2021)
- Mark Simons, CALIFORNIA EVIDENCE MANUAL §§ 4:1 *ff*.
- CEB, ACTION GUIDE: HANDLING EXPERT WITNESSES IN CALIFORNIA COURTS

Other Resources

- Podcasts. Some of my *Sidebar* podcasts may be of interest, found at http://www2.courtinfo.ca.gov/cjer/judicial/2615.htm, titled "Sidebar: Why We Need Statistics" and "Sidebar: Experts". See "Expert Witnesses: A Sampler of Current Issues," http://wpc.1a57.edgecastcdn.net/001A57/cjer/podcast/BestPractices-SB-Experts-Jun2020.mp3
    - Related materials are at, e.g., http://www2.courtinfo.ca.gov/cjer/judicial/documents/secured/pod-bp-experts-Karnow.pdf
- Curtis Karnow, "The Opinion of Machines," XIX COLUMBIA SCIENCE & TECHNOLOGY LAW REVIEW 136 (2017-2018), STLR.ORG, *republished & updated in* CAMBRIDGE HANDBOOK OF THE LAW OF ALGORITHMS (2020) (includes a review of the admissibility of computer-stored and computer-generated evidence, including computer simulations)
- Curtis Karnow, "Scientific Evidence: Grand Theories And Basic Methods," CORNELL LAW REVIEW (online) (forthcoming), preprint at https://works.bepress.com/curtis_karnow/53/

Further materials are listed in the Appendix: "Resources: Experts, Statistics, Science & Bad Science"

I. Procedure

1.1 *Kelly* distinguished.

Aside from a discussion of pattern evidence at § 2.11, this guide will not further explore the ramifications of *People v. Kelly*, 17 Cal.3d 24 (1976), which case continues to be the law in this state. *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747, 772 n.6 (2012). See generally, *People v. Jackson,* 1 Cal. 5th 269, 308 *ff*. (2016). *Kelly* outlines the procedures used to introduce new scientific procedures, not classic expert testimony. *Kelly* addresses the problem of juries confronted by a 'black box' (this is my own term) which might appear to produce irrefutable scientific results, and ensures that the techniques used (the mechanism of the box, as it were) are indeed generally accepted in the relevant scientific community. The point is to "forestall the jury's uncritical acceptance of scientific evidence or technology that is so foreign to everyday experience as to be unusually difficult for laypersons to evaluate." *Roberti v. Andy's Termite & Pest Control, Inc.*, 113 Cal. App. 4th 893, 901 (2003) (internal quotes omitted). If a technique "appears *in both name and description* to provide some definitive truth which the expert need only accurately recognize and relay to the jury," *Kelly* is likely implicated*. People v. Leahy,* 8 Cal. 4th 587, 606 (1994). One example is the horizontal gaze nystagmus (HGN) field sobriety test discussed in *Leahy*. So too some DNA based evidence, *People v. Venegas*, 18 Cal. 4th 47, 53 (1998); *People v. Soto,* 21 Cal. 4th 512, 519 (1999), as well as a "scent transfer unit" which "extracts scents from an object and transfers the scents to a sterile gauze pad" to enable dogs to track a scent*. People v. Mitchell,* 110 Cal. App. 4th 772, 779, 787 (2003). See also e.g., *In re Jordan R.*, 205 Cal. App. 4th 111, 128 (2012) (polygraph examination- not accepted). See generally *People v. Hardy*, 65 Cal. App. 5th 312, 279 (2021). *People v. Davis*, 75 Cal.App.5th 694, 711 (2022).

Kelly has three prongs for admissibility of the results from the black box: "(1) reliability of the method must be shown by demonstrating the technique has gained general acceptance in the scientific community; (2) the witness must be qualified as an expert before giving an opinion on the subject; and (3) correct scientific procedures must be followed in the particular case." *People v. Randolph*, 28 Cal. App. 5th 602, 611 (2018).

Once a published appellate decision has affirmed admission of a technique, no further hearings in other cases are needed to establish the technique's acceptance until and unless new evidence suggests a relevant change in the scientific community's views. *People v. Doolin*, 45 Cal. 4th 390, 447 (2009). Difficult issues can arise determining if a technique approved in a prior case is sufficiently similar to the one presented in a new case. E.g., *Doolin*, 45 Cal. 4th at 448.

1.2 Lay 'opinion' distinguished.

Lay "opinion" is not opinion at all. It is a summary or abstract of a percipient witness' testimony. To be admissible it must only be rationally based on the perception of the witness and helpful to a clear understanding of the testimony. Evid. C. 800; *People v. McAlpin*, 53 Cal. 3d 1289, 1306 (1991). By definition it requires no expertise, and any ordinary person might provide it. *People v. Chapple*, 138 Cal. App. 4th 540, 547 (2006). So for example a witness might testify someone was speeding, or drunk, or seemed healthy or unhealthy. *McAlpin,* 53 Cal. 3d at 1307. Lay opinion includes "nontechnical aesthetic issues of size and general appearance" of a building project. *Georgetown Pres. Soc'y v. Cty. of El Dorado*, 30 Cal. App. 5th 358, 379 (2018). It also includes a detective describing events of a surveillance video, based on her repeated views of the video, where she picked up details not salient on the first view (the video was later seen by the jury). *People v. Son*, 55 Cal. App. 5th 1163 (2020). But where the issue is

whether a piece of body armor has a set "ballistic resistance" to bullets is a matter for expert opinion. A police officer could conceivably have been such a witness, but he was not offered *as* an expert so his expert views were inadmissible. Because his views on the qualities of the armor were not based on a lay (non-expert) background, they were inadmissible as lay opinion. *Chapple*, 138 Cal. App. 4th at 548–49 (2006).

1.3 'Consulting expert' distinguished.

Lawyers consult with experts all the time, but many of those consultations are not with people expected to *testify at trial*, and thus they, and their work for and communications with lawyers, are not the subject of this guide. Communications with consulting experts are protected. So "the attorney-client privilege applies to communications made by the client or the attorney to the expert" and "a consulting expert's report, prepared at the attorney's request and with the purpose of assisting the attorney in trial preparation, constitutes work product." *DeLuca v. State Fish Co.,* 217 Cal. App. 4th 671, 688 (2013). But sometimes the consulting expert becomes a testifying expert: for example the person is formally disclosed under the procedures outlined below. In that case the protections disappear. *Bolles v. Superior Court*, 15 Cal. App. 3d 962, 963 (1971). The protections may reappear if the designation as a testifying expert is withdrawn and materials have not yet been disclosed. *Shadow Traffic Network v. Superior Court*, 24 Cal. App. 4th 1067, 1081 (1994).

In some types of cases lawyers must consult with a professional in advance of suit and obtain a certification of merit, essentially an opinion that the case is not frivolous. Weil & Brown, et al., CALIFORNIA PRACTICE GUIDE: CIVIL PROCEDURE BEFORE TRIAL ¶ 1:873 *ff*. (Rutter: 2022) (suits against architects, engineers and land surveyors) ("Rutter"); *Price v. Dames & Moore*, 92 Cal. App. 4th 355, 359 (2001). Communications with these are protected, CCP 411.35 (e), although their substance might be disclosed if plaintiff loses the case. Rutter ¶ 1:892. There are similar procedures in other situations such as cases based on Proposition 65 which bars chemical exposure without a warning on chemicals known to the state to cause cancer or reproductive toxicity. *DiPirro v. Am. Isuzu Motors, Inc.,* 119 Cal. App. 4th 966, 970 (2004) ("certificate of merit" must state the plaintiff has consulted with an expert who reviewed facts, studies, or other data" regarding the chemical exposure at issue, and believes "there is a reasonable and meritorious case for the private action") (internal quotes removed). When the suit is done, the court may review the basis for the certificate of merit and, if it is frivolous, award sanctions to the defendant. *Consumer Advocacy Grp., Inc. v. Kintetsu Enterprises of Am*., 150 Cal. App. 4th 953, 965 (2007).

1.4 Non retained trial expert.

Some testifying experts are known as "non-retained". They have not been selected or hired by the parties, but factor at trial because they are percipient witnesses and their testimony will involve their expertise. The classic case is the treating doctor. She may have seen an injury in the emergency room, or treated later. The doctor can only explain what happened, what she did and what she saw by reference to her expertise. Other examples are police officers, or others who might testify as an expert but whose opinions are formed as part of their normal occupational duties. *Belfiore-Braman v. Rotenberg*, 25 Cal. App. 5th 234, 237 n.2 (2018); *Easterby v. Clark*, 171 Cal. App. 4th 772, 782 (2009). The scope of a non-retained expert is strictly limited to the information acquired while performing the expert's work; in the case of a doctor, the testimony "is based entirely on information he acquired while he was treating [plaintiff] as a patient." *Easterby*, 171 Cal. App. 4th at 782. All experts must be *disclosed* to the other parties, 2034.260(b), but non-retained experts need not appear in the expert *declaration*,

Schreiber v. Estate of Kiser, 22 Cal. 4th 31, 33 (1999); and they must be subpoenaed to appear at trial: unlike retained experts, non-retained experts need not respond to a notice to appear at trial.

The distinction between retained and non-retained can be crucial when, for example, they were not the subject of the expert declaration. A doctor who begins as a non-retained expert by virtue of his examination of the plaintiff at hospital, for example, is

> transformed into a retained expert, such as where counsel supplies the physician with "additional information and ask[s] him to testify at trial to opinions formed on the basis of that additional information." (*Dozier v. Shapiro* (2011) 199 Cal.App.4th 1509, 1521….) When that occurs, the treating physician goes beyond the traditional role of examining a patient by receiving additional materials from counsel after his deposition and using them to form an opinion about another doctor's adherence to the standard of care, and the rules for disclosing new information from a retained expert apply.

Belfiore-Braman v. Rotenberg, 25 Cal. App. 5th 234, 245–46 (2018). If the "transformed" retained expert was not the subject of an expert declaration, the expert cannot testify on subjects other than those within the scope of his *non*-retained scope.

1.5 Parties as Experts.

An individual party, or an employee of a party, may also act as a testifying expert. For example, if an architect is sued, he may testify as an expert architect, assuming the usual rules on admissibility are met. Party-affiliated experts must be on the expert disclosure, 2034.210 (a) and (b), as with any other expert; and they must also be the subject of the expert declaration. 2034.210(b).

1.6 Trial Experts: Procedure.

1.6.1 Overview.

Expert discovery takes place within the last few months before trial. It is triggered by a written demand, without which there are no statutory procedures for expert discovery and any expert may be able to testify at trial. If there is a written demand, expert discovery is then tightly regulated: The demand is followed by simultaneous disclosure of experts; then a supplemental disclosure of experts in areas selected by opposing parties as to which a party has not yet designated an expert. An expert declaration with certain information is required, and usually an exchange of relevant documents. Then depositions take place, and then testimony at trial. All these events occur simultaneously for the parties; i.e. there is a simultaneous exchange of information, relevant reports, and so on, as opposed to a staggered process with e.g. plaintiff disclosing before a defendant. As noted below parties may stipulate to a staggered schedule and other modifications. Most of the documents prepared in the course of expert discovery are not filed unless and until the court sees them in the context of a motion. CRC 3.250 (a) (12) – (16).

1.6.1.1 Experts in Condemnation Cases.

Procedures for expert discovery in condemnation cases are unique, and not discussed here. See Weil & Brown, et al., CALIFORNIA PRACTICE GUIDE: CIVIL PROCEDURE BEFORE TRIAL ¶¶ 8:1788 *ff*. (Rutter: 2022).

1.6.2 The Trigger.

Any party may trigger expert discovery by making a written demand. Once one party has done so, it affects all parties: every party must then follow the prescribed procedures in disclosing experts, or else be barred from using expert testimony at trial. CCP 2034.230.

Without a trigger, there is no expert statutory expert discovery; and any expert may testify at trial. *Hirano v. Hirano,* 158 Cal. App. 4th 1 (2007), as modified (Jan. 2, 2008). It is not known if, absent a triggering demand, a party may be able to secure some pretrial discovery on experts or their opinions, such as by issuing an interrogatory including a contention interrogatory, or e.g., a request for production of an expert report or materials the expert may rely on.

> Comment: Because the legislature has prescribed specific methods for expert discovery, it is doubtful that other means can be used as substitute when the prescribed means have not been correctly triggered. However, there are many sorts of ordinary, non-expert discovery methods which will result in the production of at least the case specific materials on which an expert would rely. Furthermore, without the statutory disclosure, it would be difficult to litigate—at least before trial, and then it's too late—the issue whether the expert report and opinions are work product,[4] seriously inhibiting the pretrial disclosure. And there are certain pretrial motions, particularly class certification and summary judgment (or adjudication) motions, which are likely to disclose at least some experts, their opinions and their bases, and which may also provide a separate rationale for expert discovery including depositions. I discuss some unique features of these motions below (Section 3).

Some parties may find it useful not to have a trigger and thus be able to surprise the other side at trial. Some parties may be unwilling to take the risk of being surprised themselves.

1.6.3 Consequences of failure to comply with procedures.

If there is a trigger, then a party which "*unreasonably"* fails to do any of the following things in a timely way may be unable to call an expert at trial: (1) list the expert, (2) submit expert witness declaration; (3) produce reports & writings; (4) make expert available for deposition. CCP 2034.260. Note that *listing* the expert is different from providing an expert witness *declaration*.

> Comment. Note the word "unreasonably." This provides the trial judge with some leeway to allow an expert to testify where the proponent's failure is immaterial, i.e., where it has not prejudiced the other side's ability to prepare for trial. See section 1.11.2 below.

But the statutory strictures must be complied with. These "expert witness disclosure requirements are intentionally rigorous," *Ajaxo, Inc. v. E*Trade Fin. Corp*., 48 Cal. App. 5th 129, 181 (2020), and are not subject to "the liberal policies of the discovery statutes," *id*. (internal quotes omitted).

1.6.4 Timetable.

The triggering demand must issue not earlier than the date the trial is initially set (CCP 2034.210), and not later than the 10th day after the initial trial date is set, or 70 days before initial trial date, whichever

[4] CALIFORNIA JUDGES BENCHBOOK: CIVIL PROCEEDINGS, DISCOVERY § 23.20 (2021).

date is closest to the trial date. CCP 2034.220. The demand includes in it the date for disclosure, consistent with the statutory deadlines listed just below. CCP 2034.230(b). The demand may (and usually does) also require the production of expert reports and writings. CCP 2034.210(c); 2034.270.

A word on these dates, virtually all of which are set by reference to the trial date. This is, as suggested above but not expressly called out below, the date *initially* set for trial. CCP 2024.020(b). When the trial date is shifted, the discovery deadlines do not shift accordingly, unless the court so orders (CCP 2024.050) or, presumably, the parties so stipulate.[5]

The disclosure of experts must be served by all parties *simultaneously*. It is done no later than 50 days before initial trial date, or 20 days after service of demand, whichever date is closest to the trial date. CCP 2034.230. If an party does not intend to call an expert, the party must so state in its disclosure statement. CCP 2023.260 (b)(2). (Critically, this requirement is not met by simply remaining silent concerning whether experts will be called.) If experts are to be called, the disclosure includes these items: (1) a list of expert witnesses' name and address and (2) an expert declaration. Non-retained experts must be listed on the list; they are not the subject of the expert declaration. Note that this declaration is not sworn to by an expert; it is sworn to by the proponent's lawyer. The expert declaration must include: (a) the substance of the expert's testimony; (b) a statement of the expert's qualifications; (c) the statement that the experts have agreed to testify at trial; (d) the statement that the experts are sufficiently familiar with the case that they can now attend their depositions; and (e) the experts' fees and rates. The declaration is under penalty of perjury.[6]

Testifying outside the scope of the witness disclosure in the expert witness declaration can be fatal: it permits the trial judge to exclude the testimony. For example, disclosing one damages (royalties) model will not permit testimony on a different model, even if there is a last minute opportunity for the expert's deposition on the second model, because that's not "fair notice" of the substance of the expert opinion. *Ajaxo, Inc. v. E*Trade Fin. Corp.,* 48 Cal. App. 5th 129, 181 (2020).

A party may not simply "reserve the right" [sic] to call experts named by other parties. *Gallo v. Peninsula Hospital*, 164 Cal.App.3d 899, 903-04 (1985). There is no such right. And designating 'past and future treating doctors' is ineffective when they are not named. *Kalaba v. Gray*, 95 Cal. App. 4th 1416, 1423 (2002).

If the triggering demand required discoverable reports and writings, then those too must be produced at the time of disclosure. 2034.270.

> Comment. In contrast to federal practice, the creation of discoverable reports is optional in state courts. Compare e.g. FRCP 26(a)(2)(B) (some reports required). But plotting to avoid the creation of a written report until after it will be useful at deposition is very risky. Intentionally manipulating the process in this way may lead to the exclusion of the expert. *Bos. v. Penny Lane*

[5] But "in the case of a mistrial, order granting a new trial, or remand for a new trial after reversal of a judgment on appeal, the last date for completing discovery is 15 days before the date initially set for the *new* trial of the action." *Fairmont Ins. Co. v. Superior Court*, 22 Cal. 4th 245, 247 (2000) (emphasis supplied).

[6] That is to say, it must comply with CCP 2015.5. This means that, for example, declarations by out of state lawyers which are under penalty of perjury of the laws of the United States or of some other state will *not* do. E.g., *Kulshrestha v. First Union Com. Corp*., 33 Cal. 4th 601, 617 (2004) cited by *Sweetwater Union High Sch. Dist. v. Gilbane Bldg. Co.*, 6 Cal. 5th 931, 941 (2019).

Centers, Inc., 170 Cal. App. 4th 936, 952 (2009). But even if it does not, because no privilege or work product protection blocks discovery of communications between the testifying expert and counsel, the plot will come to light and injure the expert's credibility, as well as that of the involved lawyer. Furthermore, opposing parties may argue that any expert worth his or her salt would have made a report earlier in the process, to ensure important analyses and bases were recalled, insinuating at least incompetence or inexperience on the part of the expert.

1.6.5 Supplemental Experts.

Supplemental discovery of experts is permitted but only under certain circumstances. 2034.280. The supplemental disclosure must be served not later than 20 days after initial disclosure date. The supplemental expert disclosure (i) must be on a topic which some other *adverse* party had already disclosed an expert, but (ii) not on a topic which the proffering party has previously disclosed an expert. In other words, this is *not* a means by which one expert may be substituted in for another, *Basham v. Babcock,* 44 Cal. App. 4th 1717, 1723 (1996), nor is it a means by which a new area of expertise may be for the first time introduced into the case. The supplemental disclosure must be accompanied by the discoverable reports and writings (if required by the triggering demand) and an expert declaration (signed by counsel) with a statement that the expert is immediately available for a deposition. See generally *Du-All Safety, LLC v. Superior Court of Alameda Cty.,* 34 CA5th 485 (2019); *Easterby v. Clark,* 171 Cal. App. 4th 772, 781 (2009) (citing Weil & Brown, PRACTICE GUIDE: CIVIL PROCEDURE BEFORE TRIAL ¶ 8:1718 (Rutter Group 2007)).

Comment on supplemental experts. It is permissible to wait and see if another party will have an expert before deciding to nominate one in an area covered by the opposing side's expert; at least if one has issued, initially, either some list of expert (e.g. in other areas) or a statement than none is designated.[7] But it is foolish to do so on any issue as to which the party has the burden of proof, because in that case the other parties will simply not designate an expert in the area, thereby barring the first party's experts in the area. So for example if a plaintiff must prove failure to adhere to a professional standard in a malpractice case, then if there is a demand for experts, the plaintiff had better initially disclose experts on that standard, because if plaintiff waits to see what the defense does, the defense may disclose no experts in that area which then will block a supplemental disclosure by plaintiff. By the same token, it is fallacious to charge a party with gamesmanship or a malicious "wait and see" approach simply because the party did not disclose an expert until after another party did so in a certain area: the statute contemplates exactly that behavior, and the supplemental experts are not "rebuttal" experts or secondary experts in any way: they will testify at trial just like experts initially disclosed.

Comment. This approach under state law contrasts with federal practice. Under FRCP 26, parties make initial disclosures 90 days before trial, and then within 30 days after the initial disclosure another party may designate experts to rebut or contradict the initial experts. FRCP 26 (a)(2) (D). Those experts are limited to that rebuttal role, which means that for example, plaintiff rebuttal experts cannot testify in "Plaintiff's case-in-chief, and they cannot testify unless and until [defense] experts testify as to the opinions for which [the rebuttal experts] have been designated as rebuttal experts." *Lindner v. Meadow Gold Dairies, Inc.,* 249 F.R.D. 625, 636 (D.

[7] E.g., *Fairfax v. Lords*, 138 Cal.App.4th 1019, 1025 (2006) (to comply with statute one must either list experts one expects to call or "state that [party has] … no present intention to offer expert testimony.")

Haw. 2008). See generally, *Slagowski v. Cent. Washington Asphalt*, No. 2:11-CV-00142-APG, 2014 WL 3001951, at *3 (D. Nev. July 1, 2014).[8]

Expert discovery should be completed 15 days before the date initially set for trial. 2024.030. "Completed" has a special meaning: It means the day a response is due or a deposition is commenced. 2024.010. If there are supplemental experts, discovery as to them may be had closer to trial. 2034.280. Lawyers and judges frequently confuse matters by using phrases such as "close of discovery," "last day for discovery," or "end of discovery."

Motions relating to expert discovery must be heard by the 10th day before trial. 2024.030. If a party wishes a motion heard closer to trial, it must seek permission to extend that deadline. *Pelton-Shepherd Indus., Inc. v. Delta Packaging Prod., Inc.,* 165 Cal. App. 4th 1568, 1587 (2008). Various sorts of motions are discussed below.

Comment on expert discovery close to trial. Because depositions need only *commence* 15 days before trial, they may not be completed until just a few days before trial. This makes it difficult not only to have motion practice within the 10 day period of 2024.030 (recall that such motions require a prior meet and confer, e.g., CCP §§ 2034.250, 2034.470(b), 2034.610 (c)), but also to conduct trial preparation generally, which includes so much more than girding for experts. Parties should thus consider stipulations to modify the statutory timetables. Judges, even in complex cases, may not have the authority to modify the deadlines unilaterally. *Hernandez v. Superior Court*, 112 Cal. App. 4th 285, 299–300 (2003). Discovery deadlines are significant issues of case management, and modifying them may be useful. Deadlines earlier than those set by statute can ease the burden and stress of pretrial preparation. Parties might opt for the federal model of staggered initial and rebuttal experts. In some cases with shifting burdens, parties might choose expert disclosure staggered by party; e.g., in a Proposition 65 case where plaintiff has the burden in phase 1 and defendant the burden in phase 2, plaintiff's experts might be disclosed first and then in phase two, disclosure of defendant's experts first. The same approach could be used segregating experts on plaintiff's case in chief and affirmative defenses; or in some employment discrimination cases. E.g., *Cornell v. Berkeley Tennis Club*, 18 Cal. App. 5th 908, 926 (2017) (shifting burdens). And the parties might agree that production of certain documents which all parties have (such as various governmental reports and studies) need not be produced. Parties may even agree that they will not produce communications between experts and counsel.

1.6.6 Expert Depositions.

Although most depositions must last no longer than 7 hours (or in complex cases 14 hours), expert depositions are exempt from these constraints. CCP 2025.290 (b)(2). The retained expert's reasonable and customary fees must be paid by the party noticing the deposition. CCP 2034.430. These fees need

[8] To be distinguished from both the originally disclosed experts and the rebuttal expert are what some federal courts call "true rebuttal" experts which are *impeaching* witnesses—those testifying that the facts relied on by an experts are false. *Wegener v. Johnson,* 527 F.3d 687, 690–691 (8th Cir. 2008). Both state (see section 1.9 of this guide) and federal courts allow these impeachment witnesses to testify even if not previously disclosed, although in both court systems the scope is strictly limited. (The area is ripe for confusion: the term 'true rebuttal' conflates rebuttal with impeachment. Counsel make the same conflation. E.g., *Rodriguez v. Olin Corp*., 780 F.2d 491, 496 (5th Cir. 1986).) See section 1.9 below.

not be paid for certain non-retained experts. CCP 2034.430 (a), (f). Usually these are hourly fees but if the expert was noticed for a full day, or had to forego other work that day, the expert can charge a daily rate regardless of how much time was spent at the deposition. CCP 2034.430 (e).

Retained experts can be the subject of a notice for deposition; a subpoena is not required. 2034.210(b); 2034.430.(a)(1). Non-retained experts such as doctors who treated a plaintiff must be subpoenaed. 2034.010 ff. *Hurtado v. W. Med. Ctr.,* 222 Cal. App. 3d 1198 (1990).

As suggested above, communications with a testifying expert, and the expert's materials, are not protected by the work product privilege. Typically communications between the expert and retaining counsel are a focus of depositions, including all materials exchanged between counsel and the expert.

> Comment: The Magic Question and New Opinions. Depositions may be well or badly done, and the fact that the expert does not testify on a matter is not a ground to bar the testimony at trial—the relevant questions may never have been asked in the deposition. Thus, the examiner must conclude the deposition by asking if there are any opinions the expert has for trial which have not yet been discussed at deposition, and whether there is any further work the expert will do to prepare for trial. Only in this way can new opinions be barred at trial.[9] If a proponent counsel does learn that the expert has a new opinion (or a new basis) after what appears to be a complete deposition, the expert must be made available immediately for a further deposition; and the proponent would be wise to do so with no additional burden (e.g. fees, travel costs etc.) to the other side, as a way of minimizing the risk that the new opinion may be barred at trial. Unless there is a reasonable opportunity for the further deposition, it will be as if the expert was not made available for deposition on the new subject, which is one of the classic grounds on which opinions are excluded at trial. *Dozier v. Shapiro,* 199 Cal.App.4th 1509 (2011) (testimony excluded and then case dismissed because expert opinion was required).

1.7 Different testimony at trial.

An expert may seek to testify differently at trial than she did at deposition. If the scope of testimony differs, that is if she testifies on areas not disclosed at deposition (or beyond the scope outlined in the proponent attorney's expert declaration), then she may not testify if the other side had insufficient notice to prepare for that testimony:

> a party's expert may not offer testimony at trial that exceeds the scope of his deposition testimony *if* the opposing party has no notice or expectation that the expert will offer the new testimony, or *if* notice of the new testimony comes at a time when deposing the expert is unreasonably difficult.

Dozier v. Shapiro, 199 Cal. App. 4th 1509, 1523–24 (2011). But it is a different matter if the expert testifies within the scope, but simply not consistently with her deposition. As with any witnesses, that conflicting evidence is admissible, perhaps subject to a withering cross examination. *Easterby v. Clark*, 171 Cal. App. 4th 772, 781 (2009).

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[9] The reader may be familiar with the so-called 'Kennemur objection,' based on *Kennemur v. State of California*, 133 Cal.App.3d (1982), which cites the failure of the expert disclosure and failure at deposition to state an opinion in support of exclusion of the undisclosed opinion. See e.g., Lawrence Riff, "Stay Clear of the Kennemur Objection," *ABTL Report-Los Angeles* (Summer 2017).

1.8 Withdrawal of experts.

A party may withdraw an expert and so reinstate any protections regarding communications which have not already been exposed, such as the attorney work product protection. *Cty. of Los Angeles v. Superior Court*, 222 Cal. App. 3d 647, 657–58 (1990); *Shooker v. Superior Court*, 111 Cal. App. 4th 923, 928 (2003). But there is an exception. Where withdrawal of an expert witness directly flowed from defendants' illegal agreement to suppress evidence, full disclosure of the expert witness' report was required to prevent defendants from reaping any untoward benefit from their attempted illegal agreement. *Williamson v. Superior Court,* 21 Cal. 3d 829 (1978).

1.9 Testimony from undesignated experts.

There are essentially two situations where, even though a demand was issued and an expert was undisclosed by a given party, the expert may nevertheless testify for that party.

The first situation is when some *other* party designated the expert *and* the expert's deposition was taken. Even if the initially sponsoring party has withdrawn from the case such as by settlement, the expert may testify at trial at the behest of some other party. 2034.310; *Unzueta v. Akopyan*, 42 Cal.App.5th 199, 218–219 (2019).

The second situation concerns impeaching experts. In federal court impeaching experts are disclosed in the second round of disclosures. But in state court, they are not disclosed at all. Perhaps concomitantly, the scope of their testimony is highly circumscribed. Impeaching experts in state court may only attack the predicates or foundations of the adverse witness's opinions, such as the existence or not of assumed facts. They may never provide an opinion in contradiction to the adverse witness's opinions. 2034.310 (b). *Mizel v. City of Santa Monica*, 93 Cal. App. 4th 1059, 1068 (2001); *Pina v. Cty. of Los Angeles*, 38 Cal. App. 5th 531, 546 (2019). This scope is far narrower than 'impeachment' as the term is more generally understood, which otherwise might encompass any sort of attack, undermining, or disputation of the target expert or her opinion. *Howard Contracting, Inc. v. G.A. MacDonald Constr. Co.*, 71 Cal. App. 4th 38, 53–54 (1998, *modified* Jan. 20, 1999).

For example, if a hydrologist opines that a pesticide travels 10 feet a month through soil, assuming the soil is sandy, an impeaching expert may testify the soil is not sandy. See generally, *Tesoro del Valle Master Homeowners Assn. v. Griffin,* 200 Cal. App. 4th 619, 641 (2011). But if an expert testifies that his opinion does not depend on a certain fact—for example, that he does not know that a fact is true but that this doesn't matter—the impeaching expert may not address that fact. *Pina*, 38 Cal. App. 5th at 548. Impeaching experts may *not* testify that the adverse expert misapplied or did not understand the relevant body of expert knowledge, because this in effect would be impermissible contrary opinion. *Pina*, 38 Cal. App. 5th at 546. See also *Fish v. Guevara*, 12 Cal. App. 4th 142, 146 (1993) (undisclosed expert did not perform permeability test on soil that would allow testimony on permeability as matter of fact and therefore his proposed testimony did not contradict foundational fact testified to by defendants' experts, but instead offered impermissible contrary opinion on permeability rate).

But permissible targets of impeaching experts need not be, strictly speaking, facts: they can also be foundational opinions. Experts may assume and rely on the validity of other experts' opinions. E.g., *People v. Yates*, 25 Cal. App. 5th 474, 484 (2018) ("experts were permitted to rely on … any reports

other experts such as appellant's treating personnel prepared"). For example, an expert might rely on another opinion such as that an MRI shows nerve compression, used in turn to support an opinion at trial that e.g., further surgery will or will not be needed. In that case, an impeaching expert may testify that the MRI does *not* show nerve compression. *Pina*, 38 Cal. App. 5th at 549.[10]

Again, a disclosed expert may rely on the opinions of other, undisclosed experts. So for example a metallurgist may commission stress tests by an undisclosed expert, and rely on those stress tests while giving his metallurgical opinion. *Williams v. Volkswagenwerk Aktiengesellschaft*, 180 Cal.App.3d 1244, 1258-59 (1986).[11] (But note that if the stress tests are case-specific they may need a separate basis for admission, per *People v. Sanchez,* 63 Cal.4th 665 (2016). See § 2.9 below.)

Note that in state court there are no 'rebuttal experts' as such, even though the term may be found in some opinions. E.g., *Tesoro del Valle Master Homeowners Assn. v. Griffin*, 200 Cal.App.4th 619, 641 (2011); *Kim v. Cty. of Monterey,* 43 Cal. App. 5th 312, 321 (2020). There are just impeachment experts, and of course ordinary experts the subject of adequate pretrial disclosure may testify on "rebuttal" within the scope of their expertise.

> Comment: Discovery of undisclosed expert. It may be that the first time a party realizes an expert had provided key materials on which a disclosed expert relies is at the latter's deposition. By then it may be too late to do much discovery of the former, relied-on, expert. One solution is for parties to agree that experts will create reports which at a minimum will disclose relied-on experts and their findings. (The Discovery Code, e.g., CCP § 2034.210 (c), does not mandate what must be in these reports.)

1.10 Court appointed experts.

This is relatively rare in state courts, but some opinions have suggested trial judges give more thought to this. The procedure is authorized by Evid. C. 730. A relatively recent case notes:

> The use of experts to assist the court as consultants can be beneficial in complex cases. We note Federal Rules of Evidence, rule 706 also applies to court-appointed expert witnesses. Cases

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[10] This is entirely different from a disclosed expert in effect regurgitating or repeating the opinions of other, undisclosed, experts. Those are not admissible, whether or not elicited under the guise of offering putatively non-case specific hearsay under *People v. Sanchez,* 63 Cal.4th 665 (2016). *Strobel v. Johnson & Johnson*, 69 Cal.App.5th 34, 822, 827-28 (2021) review filed (Nov. 1, 2021). See § 2.10.1 below.

[11] However, compare *Wicks v. Antelope Valley Healthcare Dist.,* 49 Cal. App. 5th 866, 881 (2020). The case reads, "An expert may not predicate an opinion on the opinion of another expert," citing *Christiansen v. Hollings* (1941) 44 Cal.App.2d 332, 347 to the effect that "it is, of course, the rule ... that the opinion of an expert cannot be predicated on the opinion of another expert." It is not clear how to take this. The quote is dicta in *Christiansen*, which cited in turn an old Maryland case which seems to disapprove the incorporation of another person's opinion in the formulation of a hypothetical question to the expert. *Mt. Royal Cab Co. v. Dolan,* 168 Md. 633, 179 A. 54, 55 (1935). The facts in *Wick* were that the expert based his opinion on that of a second expert—and that second expert actually relied on the first. Obviously, that will not do. Perhaps *Wicks* meant that an expert may not in effect simply regurgitate the opinion of a different (non-testifying) expert, which is true. See footnote immediately above.

> addressing this rule may prove helpful to our trial courts. As was observed in *Leesona Corp. v. Varta Batteries, Inc.* (S.D.N.Y. 1981) 522 F.Supp. 1304, 1312: "[A] court expert serves not only as a witness on whose opinion the Court can rely for assistance, but also as both a second set of ears for the court and a teacher who, unaffected by his having been called as a witness by one side or the other, can explain the technical significance of the evidence presented. [¶] Naturally a court will rely heavily on and give great weight to the testimony of its own expert ...." [¶] California courts have acknowledged the value in court-appointed assistance from experts, especially in complex cases presenting issues beyond a trial judge's knowledge. (*People ex rel. Brown v. Tri-Union Seafoods, LLC* (2009) 171 Cal.App.4th 1549, 1573–1574, 90 Cal.Rptr.3d 644; *Mercury Casualty Co. v. Superior Court* (1986) 179 Cal.App.3d 1027, 1032, 225 Cal.Rptr. 100.)

Duran v. U.S. Bank Nat'l Assn., 19 Cal. App. 5th 630, 636 n.5 (2018). See also e.g., *People ex rel. Brown v. Tri-Union Seafoods, LLC*, 171 Cal. App. 4th 1549, 1573–74 (2009); *Smith v. Ogbuehi*, 38 Cal. App. 5th 453, 459, 477 (2019) (discretionary appointment of an expert under Evid C. § 730 may be needed to ensure indigent prisoner has meaningful access to the courts). There is a long history to court appointed experts. E.g., Ellen E. Deason, "Court-Appointed Expert Witnesses: Scientific Positivism Meets Bias and Deference" 77 OR. L. REV. 59, 64 (1998); Note, "Appointment of Expert Witnesses by the Court," 24 HARV. L. REV. 483 (1911).

The practice has been enthusiastically urged by retired Judge Richard Posner of the Seventh Circuit:

> A big problem with jury trials is that often they involve technological or commercial issues that few jurors understand (not that many judges understand them either) and that the lawyers and witnesses are unable or unwilling to dumb down to a level that the jurors would understand. There is a solution to this problem, however, though one that few judges employ: appointment by the judge of an expert witness (thus a "neutral" expert, by virtue of not having been selected by the lawyer for one party to the litigation). The authority to make such an appointment is explicitly conferred on federal judges by Rule 706 of the Federal Rules of Evidence, but is alien to the Anglo-American judicial culture, in which the witnesses in a case are designated by the lawyers rather than by the judge.
>
> The fault is the culture. Our legal culture, in contrast to that of most countries in the world (notably Japan and the nations of Continental Europe), is "adversary," in the sense that the judge is the arbiter of a contest–a drama, really – put on by the lawyers for the contending parties. . . .

Richard A. Posner, "What Is Obviously Wrong With The Federal Judiciary, Yet Eminently Curable Part I" 19 GREEN BAG 2D 187 (2016), http://www.greenbag.org/v19n2/v19n2_articles_posner.pdf. See also Judge Posner's opinion in *ATA Airlines, Inc. v. Fed. Exp. Corp*., 665 F.3d 882, 889 (7th Cir. 2011) where he makes the point that getting a court expert is better than ignorantly ruling on (there, statistical) issues.

Judge Posner's lead was strongly endorsed in an interesting opinion, which urges both (i) caution at junk science purchased by the parties, and (ii) trial judges to seriously consider court-appointed experts. *Brown v. Los Angeles Unified Sch. Dist.,* 60 Cal. App. 5th 1092, 1113-14 (2021) (Wiley, J., concurring) ("And once you appoint that expert, it can be startling how fast the case settles").

Judges considering this approach will have to confront some issues. First, how will the expert be selected? Perhaps the judge will ask the American Association for the Advancement Of Science, or have the parties' experts confer and nominate someone. R. Posner, REFLECTIONS ON JUDGING 297-298 *ff*. (2013). The judge will also have to consider if she will confer with experts outside the presence of the parties (probably not), whether the judge will ask questions at trial, whether the parties may depose the expert (probably so), and who pays (perhaps either the cost is split or is treated as a cost entitlement to the prevailing party, e.g., CCP 1033.5 (a) (8)). See generally e.g., <https://www.litigationandtrial.com/2016/04/articles/attorney/frcp-706-independent-experts/> (disagreement with Posner as a result of some of these issues). Judges should be alert, too, to the notion that juries may be far more well-disposed to the conclusions of the court's expert than those of the parties, as a result of the suggestion of neutrality. This might be handled by some sort of limiting instruction or other language describing the expert's role, which might obviate the suggestion of a privileged position. But in a bench trial the judge will have to be alert to the temptation to give special credence to the court's expert.

1.11 Motions.

Motions relating to experts include these:

- To exclude other party's expert (often a motion in limine). 2034.300
- To augment or amend list of experts, to amend expert declaration. 2034.610. *Perry v. Bakewell Hawthorne, LLC*, 2 Cal. 5th 536, 541 (2017).
- To submit late disclosure. 2034. 710
- To quash untimely demand (protective order). 2034.250(a). There are no "objections" to a deficient demand. *Zellerino v. Brown*, 235 Cal. App. 3d 1097, 1099 (1991)
- To set earlier or later exchange date. 2034.230(b)
- To set a date other than that set out in the demand. 234.250 (b)(2)
- To challenge the reasonableness of the fee demanded by an expert. 2034.470(a)

The point of this list is that there is no "self-help" in this area: aside from stipulations, problems with the timing and adequacy of expert disclosure cannot be remedied by simply a re-do, such as filing a new expert disclosure at some point after the first one. Instead, parties must go to court for an appropriate order.

1.11.1 Meet and Confer.

Typically the parties must meet and confer before bringing these motions. E.g., 2034.610(c). And typically sanctions are awarded against the party losing the motion, e.g., 2034.730, that is, a fee shifting sanction to compensate the winning party.

> Comment: Fee Shifting sanctions. While the term 'sanctions' is applied to discovery motions, including many of the motions just noted, it should be understood that these are not sanctions in the usual sense, imposed for bad or unreasonable behavior. While it is possible that a victorious party in such a motion might have been the victim of abusive behavior at the hands of the other side, such a finding is not required to impose the fee shifting penalty. This imposition of the penalty is the *default* in these motions, and the burden is on the party seeking to escape the sanction, as opposed to true sanctions where the default is that they should not be imposed,

unless the party seeking them shoulders a burden of showing abusive or e.g. frivolous tactics. There is a caveat here: Even though the burden is on the accused party, the party seeking sanctions must nevertheless still ask for them (providing the requisite notice to the accused party) and must have admissible evidence, usually declarations of counsel, from which the court can find a reasonable billing rate and amount of time, for which to order compensation.

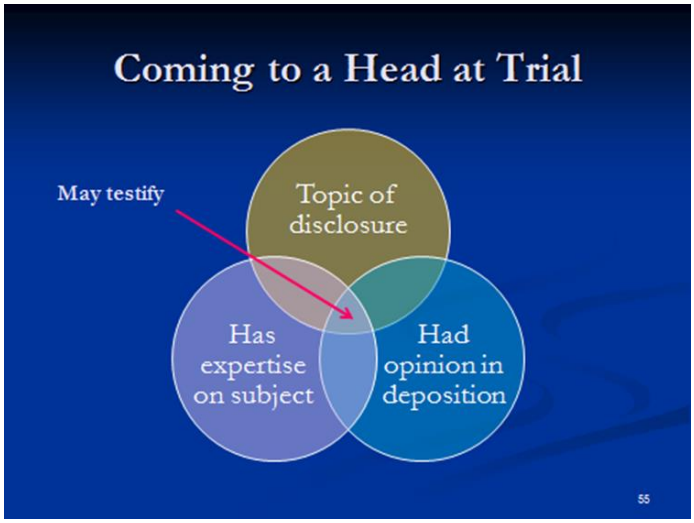
1.11.2 Excluding experts & "reasonable" actions.

The most common issue raised by motions—often a motion in limine—is whether an expert should be excluded from trial as result of the proponent party's failure to adhere to the procedural requirements outlined above. In these motions, the court looks to whether the behavior of *both* the moving party and the opposing party has been reasonable. The moving party must itself have complied with the requirements, 2034.300, and the opposing party is barred from using its experts only if its failures have been unreasonable. 2034.300. *Hirano v. Hirano*, 158 Cal.App.4th 1, 6 (2007); *Staub v. Kiley*, 226 Cal.App.4th 1437 (2014). The Code does not specify what reasonable or unreasonable behavior is, but typically it's that for which there is no good reason, or which appears calculated to prejudice the other side. *Staub*, op. cit.

However, there is a safety valve here: courts retain an inherent authority to regulate expert discovery, and for example can bar experts even when the party seeking that relief has not itself acted reasonably. "The trial court had inherent authority to exclude the testimony of Cottini's expert witnesses," *Cottini v. Enloe Med. Ctr.*, 226 Cal. App. 4th 401, 426 (2014). Parties seeking relief premised on inherent authority should expressly call that out, in addition to invoking statutory bases for relief.

Comment: Motions in limine. The parties should confer on motions in limine before they are drafted, and if that is not possible, at least before they are provided to the court for decision. Meet and confer may reveal the parties are not in disagreement, or may provide the basis for a compromise which benefits both sides. Even if this not the case, meet and confer will sharpen the issues for the court. Frequently, motions in limine and their oppositions are rote, and speak past each other, making it difficult to know where the parties truly differ. Many motions in limine are denied as moot, or unripe. The parties should consider if the motion is truly "in limine" or whether, contrariwise, the motion depends on how evidence comes in at trial and which questions are asked.

Comment: Seeking exclusion of expert testimony during trial. The scope of permissible expert testimony may be seen as the intersection in this Venn diagram:



It may not be clear until a question is asked at trial whether the expert may answer. As the diagram suggests, the expert may not have had an opinion on the issue at his deposition—having been asked what I refer to above as the 'Magic Question" in response to which he stated there was nothing more. The issue then is, how to convince the court that the deposition is devoid of the opinion now sought at trial? The issue may come up at sidebar, and the one thing the judge will not do is read through two volumes of testimony to see if the topic is there discussed. After determining that the Magic Question or some equivalent was asked, the judge is likely to turn to the expert's proponent and ask where topic was covered in the deposition. The proponent should have that answer at his or her fingertips.

2. Substantive admissibility

2.1 Typical areas for experts.

There are some cases in which an expert must testify, or else the party with the burden of proof must lose. In other cases, experts can be useful but are not required. For example, in most (but not all) malpractice cases, an expert testifying to the standard of care must testify. So in a case involving the faulty administration of anesthesia during an operation, only an expert could testify that a drug was administered for too short or too long a period, or that the wrong chemicals were used. Plaintiff must have such an expert. At trial, while the defense would be well advised to have an opposing expert, it is conceivable that the defense might win by simply destroying the credibility of the plaintiff's expert.[12]

[12] There is some language from a 1999 case, repeated in the authoritative 'Directions for Use' for CACI 219 (Experts), which could be taken to mandate at trial acceptance of a very specific type of expert evidence: "Uncontradicted testimony of an expert witness on the st*andard of care in a professional malpractice case* is conclusive. (Howard v. Owens Corning (1999) 72Cal.App.4th 621, 632-633 [85 Cal.Rptr.2d 386]; Conservatorship of McKeown (1994) 25 Cal.App.4th 502, 509 [30 Cal.Rptr.2d 542]; Lysick v. Walcom (1968) 258Cal.App.2d 136, 156 [65 Cal.Rptr. 406])" (emphasis supplied). *Howard* says this is the only type of expert testimony which is "conclusive;" other expert testimony can, like any other evidence, be rejected by the trier of fact. Does *Howard* really mean that the jury is mandated to accept such uncontradicted evidence, however weak or stupid it is, however foolish a witness testifies, however flaccid the support for the opinion? This seems very odd. So this bears some investigation. First we note that the statement of the rule is dicta in *Howard*, and dicta in other cases which cite *Howard* for the proposition. E.g., *In re Marriage of Rosen* 105 Cal.App.4th 808, 820 (2002) as modified on denial of reh'g (Feb. 19, 2003). Indeed I have not found a case after *Howard* in which the statement of the rule is not dicta. Second, *Howard* explains this proposition by quoting (at some length, 72 Cal.App.4th at 632 n.6) the case of *Liberty Mut. Ins. Co. v. Industrial Acc. Commission*, 33 Cal.2d 89, 95 (1948) which explains that "conclusive' means the testimony "may not be contradicted by the testimony of a nonexpert witness." Third, the other case cited on by *Howard* here, *Conservatorship of McKeown*, 25 Cal.App.4th 502, 509 (1994) limits this rule to "medical malpractice cases" (not any professional malpractice), and again, the recitation of the rule is dicta. When we delve into cases cited by *Liberty Mut. Ins. Co.,* again we see that "conclusive" means that the expert opinion can't be contradicted by *non*-experts. See e.g., *Hines v. Industrial Acc. Commission*, 215 Cal. 177, 187 (1932), which both (i) recites a general rule that uncontradicted expert testimony on apparently *any* subject binds the court, which is plainly not the law as even *Howard* notes, and also recites the aspect—and perhaps this is what the court meant?—that the evidence is conclusive in the sense that it cannot be "contradicted by nonexpert witnesses." See also *General Accident, Fire & Life Assur. Corp., Limited, of Perth, Scotland v. Industrial Accident Commission*, 106 Cal.App. 39, 42 (1930) (same). So what might we conclude? First, the rule actually seems to be just that lay testimony can't contradict experts. But as non-experts can *never* testify on a professional standard of care, that rule is superfluous. Second, the rationale of the rule as phrased by *Howard* dating back to e.g., *Hines*, applies to all

This is not, however, an option in summary judgment and summary adjudication. If a plaintiff seeks ummary judgment based on an admissible expert declaration that e.g. the wrong anesthetic was administered, the defense must have an adverse expert to defeat the motion and preserve the case for trial.

Not all malpractice cases need an expert. If negligence would be obvious to a layperson, no experts are needed. *Lattimore v. Dickey*, 239 Cal.App.4th 959, 969 (2015); *O'Shea v. Lindenberg*, 64 Cal.App.5th 228, 237 (2021) (no expert needed where malpractice is "utterly egregious and obvious"). So if a sponge is left in the body after surgery experts are not needed. See also *Ryan v. Real Estate of the Pac., Inc.*, 32 CA5th 637, 646-647 (2019) (P did not need expert testimony to oppose D's summary judgment motion in professional malpractice case where standard of care was "common knowledge" to laypersons). But where in surgery "retention and removal of the drain involve[ing] complex medical procedures beyond the comprehension of a layman," experts are required. *Scott v. Rayhrer*, 185 Cal. App. 4th 1535, 1547 (2010).

Experts typically testify in areas such as:

- Valuation, e.g., *In re Marriage of Hokanson*, 68 Cal. App. 4th 987, 996 (1998); *Orozco v. WPV San Jose, LLC*, 36 Cal. App. 5th 375, 397 (2019) (lost profits); *Bell v. Farmers Ins. Exch.,* 115 Cal. App. 4th 715 (2004) (statistical methodology of random sampling and extrapolation for the determination of aggregate class wide damages);
- Professional standards such as medical standards of care, e.g., *Avivi v. Centro Medico Urgente Med. Ctr.*, 159 Cal. App. 4th 463, 467 (2008);
- Medical causation and diagnosis, *Ramona v. Superior Court*, 57 Cal. App. 4th 107, 121 (1997); *Lundrigan v. City of Los Angeles*, 82 Cal. App. 2d 238, 253 (1947); *Jennings v. Palomar Pomerado Health Systems, Inc.,* 114 Cal.App.4th 1108, 1120 (2003); see also e.g., *O'Shea v. Lindenberg*, 64 Cal.App.5th 228, 239 (2021) (legal malpractice causation); "Where complexity of causation issue is beyond common experience, expert testimony is required to prove causation. In contrast, if causation presents a question that is within the common knowledge of persons of ordinary education, then expert testimony is not required." *Kaney v. Custance*, 74 Cal. App. 5th 201, 217 (2022);
- Various scientific areas, e.g., *McCoy v. Gustafson,* 180 Cal. App. 4th 56, 100 (2009) (chemicals migration); *Lyons v. Colgate-Palmolive Co.*, 16 Cal. App. 5th 463, 466 (2017) (whether talc contains asbestos);
- Statistics, e.g., *Munoz v. Chipotle Mexican Grill, Inc.,* 238 Cal. App. 4th 291, 299 (2015); *Yumori-Kaku v. City of Santa Clara*, 59 Cal. App. 5th 385, 422 (2020) (court properly relied on expert statistical study, with discretion to use a confidence interval lower than that used by expert);
- Custom and usage in an industry, e.g., *Balfour, Guthrie & Co., Ltd. v. Gourmet Farms*, 108 Cal. App. 3d 181, 190 (1980), including for contract interpretation. *Howard Entertainment, Inc. v. Kudrow*, 208 Cal.App.4th 1102, 1114 (2012); *Wolf v. Superior Court*, 114 Cal.App.4th 1343, 1355 (2004); *Scoville v. De Bretteville*, 50 Cal.App.2d 622, 629 (1942); *Law v. Northern Assur. Co. of London*, 165 Cal. 394, 407 (1913).[13]
- Why victims may appear to act inconsistently with the fact of an assault, designed to rehabilitate a victim's credibility. E.g., *People v. Munch*, 52 Cal. App. 5th 464, 468 (2020) (child

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experts; but this proves too much, for the general rule is that juries never have to accept even uncontradicted expert testimony. It seems *Howard*, and its employment in CACI 2019's Directions for Use, may be a mirage.

[13] For more on contract interpretation see my "Litigating California Contracts" 17 HASTINGS BUS. L. J. 2 (2021).

sexual abuse accommodation syndrome; *People v. Housley*, 6 Cal. App. 4th 947, 954 (1992) (rape victim); *People v. Bledsoe*, 36 Cal. 3d 236, 251 (1984) (same). One must be cautious: as *Bledsoe* notes, this sort of expert testimony cannot be used to prove an assault occurred. Nor may experts opine that a specific witness is or is not telling the truth. E.g., *People v. Bowker*, 203 Cal. App. 3d 385, 394 (1988). See *People v. Lapenias,* 67 Cal. App. 5th 162 (2021) (expert may not opine it is "rare" for children to invent stories about abuse, as that is tantamount to opinion that a witness is telling the truth; but expert may discuss Child Sexual Abuse Accommodation Syndrome (CSAAS) "to explain the typical behaviors of sexually abused children, such as delayed reporting," as evidence of abuse. Id. at 179). See Ev. C. § 1107 (expert testimony on intimate partner battering).

- Explaining the pitfalls of eyewitness testimony. *People v. Gray*, 187 Cal.App.3d 213, 219 (1986); *People v. Sotelo-Urena*, 4 Cal.App.5th 732, 754 (2016); Thomas D. Albright & Brandon L. Garrett, "The Law and Science of Eyewitness Evidence," 102 B.U. L. REV. 511, 511 (2022).

The substantive requirements for the admissibility of the testimony are outlined below.

2.2 Basic requirements for admissibility.

Experts can testify if they provide opinions which are beyond the usual capabilities of jurors; if they have the pertinent expertise; and if they have a reliable basis for their views. Evid. C. § 801. The bases of the opinion need not be admissible, *id*., but they must be "of a type that reasonably may be relied upon by an expert in forming an opinion upon the subject to which his testimony relate." *Id*. Elaborations of these basic criteria include the notion that the expert must not speculate, nor base his opinions on speculation. And there must be a logical link between the bases of the opinion and the opinion itself. Many of these issues are addressed or alluded to in the seminal case, *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747 (2012).[14] But before turning our attention to that case, a few words on some requirements not directly addressed by *Sargon*.

2.2.1 Speculation.

Opinions based on speculation are inadmissible. Testifying that an event was a possible—but not probable—result of an alleged defect is inadmissible speculation. Anything is possible. *Waller v. FCA US LLC,* 48 Cal. App. 5th 888, 890 (2020). Failing to provide an explanation of the links between the facts of the case and the opinion too may be in effect speculation; for example, without an explanation of how a series of failures at the hospital led to injury, the opinion is speculation. *Wicks v. Antelope Valley Healthcare Dist.*, 49 Cal. App. 5th 866, 880 (2020). See also, *O'Shea v. Lindenberg*, 64 Cal.App.5th 228, 239 (2021) (inability to testify to a "reasonable degree of legal certainty" on causation). This is also characterized as a failure to set forth a foundation. See § 2.8 below.

But these issues are not at stake when for example a defense expert testifies that a cause identified by a plaintiff's expert is not the only possible cause, and that there are other possible causes. Those other possible causes need not be shown to be the cause of injury to a reasonable degree of legal certainty. *Kline v. Zimmer, Inc.,* 79 Cal.App.5th 123 (2022). Thus assume a plaintiff has, as is needed, an expert testify that cause X is the cause of injury. A defense expert may testify that causes Y and Z are *possible*

[14] A case has cautioned against reliance on pre-*Sargon* opinions. *San Francisco Print Media Company v. Hearst Corporation*, 44 Cal.App.5th 952, 965 (2020).

causes, and the latter opinions must not be excluded as speculative, because they are not coming into establish the cause, but to undermine the plaintiff's expert.

2.3 Usual capacity of jurors.

As noted above, leaving a sponge in a body after surgery is a sort of negligence within the ability of ordinary people to understand: but not only then is an expert not needed, no expert is *permitted* to testify. The point is that the expert is not helpful to the jury and if so, the testimony is inadmissible. So too with witness credibility: experts aren't allowed on that subject. *People v. Wells*, 118 Cal. App. 4th 179, 189 (2004). See also, *Caloroso v. Hathaway*, 122 Cal. App. 4th 922, 928 (2004) (expert properly barred because "no expert was needed to decide whether the size or irregular shape of the [sidewalk] crack rendered it dangerous. The photographs of the crack submitted by both sides demonstrate that the crack is minor and any irregularity in shape is minimal").

Products liability cases can be nuanced. No expert testifies regarding the consumer expectation test because the idea behind that test "is that the lay jurors have common knowledge about the product's basic safety," *Verrazono v. Gehl Co*., 50 Cal. App. 5th 636, 646–47 (2020), but "where the product is in specialized use with a limited group of consumers[,] ... expert testimony on the limited subject of what the product's actual consumers do expect may be proper," *Id*. (internal quotation omitted).

The test whether a jury can determine the issue on its own is, as one might imagine, somewhat flexible. Where for example a jury could probably figure out on its own whether victims were trapped between a fence and parked cars, expert testimony is still admissible as marginally useful to the jury. *People v. Fudge*, 7 Cal. 4th 1075, 1121 (1994). In *Fisher v. MoneyGram Int'l, Inc*., 66 Cal. App. 5th 1084 (2021) an expert discussed the illegibility of an arbitration clause, and his opinion was "accepted" by the appellate court, but the court was also able to conduct the analysis on its own. *Id*. at 1097-98.

2.4 Ultimate fact.

An expert's testimony is not barred just because it restates the ultimate fact issue in a case. Evid. C. 805; *Carey v. Lima, Salmon & Tully Mortuary,* 168 Cal. App. 2d 42, 45 (1959). But if the ultimate issue is one which may be determined as well by a lay person as anyone else, the opinion is barred for that reason. The two principles are close, and language in some cases seems to conflate them. E.g., the expert's "opinion testimony was inadmissible because it usurped the jury's role," *Burton v. Sanner,* 207 Cal. App. 4th 12, 20 (2012) (actual holding seems to be, correctly, that expert "did not raise any circumstance the jury may not understand in conjunction with his necessity defense," *id*. at 798). In some cases the matter must be carefully distinguished from offering an opinion on an (ultimate) issue of law, which is barred not because it's ultimate but because it's about the law. *Towns v. Davidson*, 147 Cal. App. 4th 461, 473 (2007). See section 2.6 below.

2.5 Source of expertise.

Experts may obtain their expertise in many ways. Nuclear physicists will have it by virtue of their academic graduate and post graduate work. Pilots, plumbers and carpenters will have it by virtue of their training and years of work. One might have it having read the literature on the subject. Those with extensive experience with machines used as part of 'faith healing' regime have the requisite experience to opine on their mechanisms, but patients do not. *People v. Chapman*, 207 Cal.App.2d 557, 573 (1962). Prior qualification as an expert in court is relevant. *ABM Industries Overtime Cases*, 19 Cal.App.5th 277,

296 n.8 (2017). The fact that one does not have a "formal education and membership in professional organizations" in the area is not disqualifying when the expertise appears via experience. *ABM Industries Overtime Cases*, 19 Cal.App.5th 277, 296 (2017).

2.5.1 Emergency room expertise.

California's Health & Safety Code § 1799.110 states in part :

> In any action for damages involving a claim of negligence against a physician and surgeon providing emergency medical coverage for a general acute care hospital emergency department, the court shall admit expert medical testimony only from physicians and surgeons who have had substantial professional experience within the last five years while assigned to provide emergency medical coverage in a general acute care hospital emergency department.

This applies solely to "standard of care testimony," *Stokes v. Baker,* 35 Cal.App.5th 946, 958, 967 (2019). Despite the wording of the statute, it does not bar experts who do not have the stated experience from testifying in these sorts of cases on *other* matters such as whether negligent conduct caused a plaintiff's alleged injuries or damages. *Stokes,* 35 Cal.App.5th at 958.

2.6 Opinions on the law.

Experts must not opine on the law, the notion being of course that judges are tasked with figuring that out. *Prop. California SCJLW One Corp. v. Leamy*, 25 Cal. App. 5th 1155, 1165 (2018); *Summers v. A.L. Gilbert Co.,* 69 Cal. App. 4th 1155, 1180 (1999). Experts may testify on foreign (i.e., outside the United States) law. *In re Johnson's Estate*, 100 Cal. App. 2d 73, 76 (1950); *W.M. v. V.A.,* 30 Cal. App. 5th 64, 75 (2018), as modified Jan. 3, 2019 (expert on Belarusian law); *In re Estate of Yarovikoff*, 65 Cal. 2d 886, 887 n.1 (1966); *Manco Contracting Co. (W.L.L.) v. Bezdikian,* 45 Cal.4th 192, 204 (2008). But state judges usually decide the law of sister states without experts (although of course with briefing). E.g., *World Wide Imports, Inc. v. Bartel,* 145 Cal. App. 3d 1006, 1012 (1983). The issue of deciding the law is for the court, not a jury. Evid. C. §§ 310, *cf*. Evid. C. § 311.

2.7 Congruence of expertise and opinion.

Sometime difficult issues arise when an expert's area of expertise seems close, but not congruent, with the opinion she is to express. This arises when for example doctors in one area opine in related areas. Sometimes the issues come up when experts testify to standards of care in one geographical place when the experts are from a different place. E.g., *Brown v. Colm*, 11 Cal.3d 639, 646 (1974).[15] See *Howard Entertainment, Inc. v. Kudrow* 208 Cal.App.4th 1102, 1116 (2012) (issue of overlap between areas of talent agent and personal managers). While in some cases the fact that a doctor does not have the specific expertise at issue might be disqualifying, there are some issues which can be testified to by any doctor regardless of specialty; so an internist could testify on pain management medications prescribed by a psychiatrist. *Grafilo v. Soorani,* 41 Cal.App.5th 497, 510 (2019). See also e.g., *ABM Indus. Overtime Cases,* 19 Cal. App. 5th 277, 293 (2018) (reversing trial court determination that expertise "in creating, managing and analyzing large databases" was insufficient to allow testimony on the "timekeeping and

[15] However, it is usually reversible error to exclude an expert solely because the expert hails from a different location. See, e.g., *Avivi v. Centro Medico Urgente Med. Ctr*., 159 Cal. App. 4th 463, 472 (2008); *Borrayo v. Avery*, 2 Cal. App. 5th 304, 310 (2016).

payroll data at issue"); *LAOSD Asbestos Cases* (2020) 44 Cal.App.5th 475 (expert is geologist and not mineralogist, but his experience shows adequate experience with mineralogy); *Lowery v. Kindred Healthcare Operating, Inc*., 49 Cal. App. 5th 119, 122 (2020) (expertise as a "physiatrist, focusing on the musculoskeletal system," does not suffice for opinion in neurology).

2.8 The Logic of *Sargon*.[16]

> [I]n spite of judges' extensive experience with assessing reliability of expert testimony, judges may be no better than laypeople in identifying flawed or questionable expert methodologies. Just like jurors, who frequently rely on an expert's credentials in place of a searching assessment of methodological soundness, studies have revealed that judges do the same. In fact, there seems to be a lack of support for the argument that judges actually do critically evaluate an expert's methodology or techniques in assessing reliability. Rather, studies have found that judges, like jurors, tend to give undue weight to factors disconnected from methodological reliability.
>
> Marta M. Chlistunoff, "Expert Testimony and the Quest for Reliability: The Case for a Methodology Questionnaire" 94 TEX. L. REV. 1055 (2016).[17]

In *Sargon*, adopting some language from earlier federal cases, the state supreme court made it clear that trial judges were "gatekeepers" ensuring only reliable, valid expert testimony reached the jury. The federal cases, such as *Daubert v. Merrell Dow Pharmaceuticals, Inc*., 509 U.S. 579 (1993) and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), had themselves followed a series of complaints about bad science allowed in the courtroom, exemplified by Peter Huber's GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM (1991) (noted in e.g., *People v. Johnson, 1*9 Cal.App.4th 778, 790 (1993)). Judges and commentators were increasingly aware of the persuasive value--sometimes unjustifiably persuasive—of an expert's opinion. By definition experts testify on issues as to which the jury is incompetent—so allowing the jury to weigh expert opinion on their own to decide if it's reliable seems, to put it mildly, odd.

Thus the gatekeeper judge, meant to screen opinions without a reasonable or reliable basis. "Before *Sargon*, California courts often deferred to what was generally accepted in a particular field or accepted the professional practice of the testifying witness. After *Sargon*, trial judges have been appointed gatekeepers charged with scrutinizing the reliability of all expert evidence….. *Sargon* no longer permits trial judges to defer to some proxy professional group, but rather assigns them the weighty responsibility of inquiring how the knowledge was derived. In epistemological terms, what is the group's knowledge claim, and is there an adequate warrant for the claim?"[18] As the introductory quotation to this section suggests it's not clear how well judges have adapted to this role. Below in section 2.10.4.2.1, we will see an example where this scrutiny was not applied.

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[16] A further discussion of *Sargon* is found in the Appendix, "Sargon and the Science of Reliable Experts."

[17] To the same effect see e.g., James R. Dillon, "Expertise On Trial," 19 COLUM. SCI. & TECH. L. REV. 247, 274-75 (Spring 2018).

[18] David L. Faigman et al., "Wading into the Daubert Tide: Sargon Enterprises, Inc. v. University of Southern California," 64 HASTINGS L.J. 1665, 1682-83 (2013) (authors who wrote the law review article on which *Sargon* relied). See also e.g., these cases emphasizing the judge's role in ensuring reliable expert testimony: *People v. Brown*, 245 Cal. App. 4th 140, 164 (2016) (citing *Sargon*); *People v. McVey,* 24 Cal. App. 5th 405, 416 (2018); *People v. Jones*, 57 Cal. 4th 899, 985 (2013) (Liu, J., concurring).

A concomitant of *Sargon*'s approach is that the expert opinion must have a foundation, and the foundation must be explained to the judge. Without it, the connection between predicate and opinion is not manifest and thus the opinion is worthless. So conclusory opinions are no good. *Jennings v. Palomar Pomerado Health Sys., Inc.,* 114 Cal. App. 4th 1108, 1117–18 (2003). This is not often a problem at trial where the parties instinctively know to tease out the bases for an opinion, but as we will see when we turn to summary judgment, where expert opinions, and sometimes all of their bases and predicates, are wrapped up in a declaration, the problem is serious and sometimes fatal.

An article exploring *Sargon* in some detail is found in the Appendix. Here, I note a few basics. The case involved an expert who opined on lost profits. The general theory was acceptable, but the expert relied on an inappropriate foundation, specifically, he speculated using optimistic assumptions, which themselves had no basis, about the likely future performance of the company at issue. As a gatekeeper, the trial court had to assess whether as a matter of "logic" the articulated foundation sufficed to support the approach taken by the expert (and here it did not). *Sargon* reminds us to exclude an opinion if (a) it is based on matters experts cannot reasonably on, or (b) the reasons cited by the expert have no demonstrable basis or are, in other words, speculative.

One way of understanding *Sargon* is to focus on the notion of a logical link. Most experts have a theory which they claim to be implementing. For an accident reconstruction expert, theory might include F = M * A, that is, force equals mass times acceleration. Often the theory is implicit, and not debated. Sometimes as in *Sargon* it's that one looks to comparable companies to see how they did to evaluate how the injured company would have done but for some act, and the theory includes some notion of what "comparable" actually means. The same would be true of real estate comparables used to derive property values. *Olen Commercial Realty Corp. v. County of Orange*, 126 Cal.App.4th 1441, 1451 (2005). The theory may have to be made express and justified: In much of science, that's done with studies and experiments. Again, sometimes those are implicit and understood, such as experiments that support the theory of gravity. But there may be conflicting studies, or the studies may not support what appears to be a novel theory of how e.g., cancer is caused. Once the theory is in hand, facts specific to the case are assembled, the theory is applied to them, and an opinion results.

So we might think of studies and experiments providing the logical basis for a theory, which theory is combined with the facts of the case to produce, logically, the opinion. In a car accident case, studies and general knowledge tell the expert that F = M * A; the facts of the case might include the rubber tire markings at the scene and extent of damage (from which one calculates speed at impact, the result of different set of theories), the weight of the car, and so on, which result in the opinion that the car impacted with such and such a force. In medicine, the theory might be that cancer acts in a certain way, supported by studies and reports; the facts of the case would be the patient's examination, and the opinion would be that he has cancer, and, perhaps based on other studies and reports, together with other facts about the patient's exposures and work place, that the cancer was caused at least in part by a certain substance (such as tobacco or asbestos).

This all may seem an unnecessary elaboration of an obvious process, but the point is to tease out the points at which experts may gloss over their analyses, and to expressly call out the requirement of logical links between:

(A) (i) reports and studies, or of more widely accepted theories (such as gravitation, etc.), and general education, on the one hand, and (ii) a specific theory, on the other hand; and

(B) (i) the specific theory, together with the facts of the case, and (ii) the opinion.

Thus as to (A): there were sufficient reports and studies supporting a certain kind of asbestosis exposure theory where risk is increased by "any exposure," or "any fiber," and so the expert was allowed to testify. *Davis v. Honeywell Internat. Inc.,* 245 Cal. App. 4th 477, 480 (2016). In *Cooper v. Takeda Pharm. Am., Inc*., 239 Cal. App. 4th 555, 564 (2015), a case to which we shall return, the trial judge found insufficient bases in reports and studies to support the theory that bladder cancer could be caused by a certain drug, Actos; the court of appeal held there was a sufficient basis. *In Sanchez v. Kern Emergency Med. Transportation Corp*., 8 Cal. App. 5th 146, 162 (2017) the court found the medical literature did not support the theory that certain delay in treatment caused an injury.

Thus as to (B): an opinion which states a theory but does not relate it to the facts of the case is not admissible. *Esparza v. Safeway, Inc.,* 36 Cal. App. 5th 42, 57 (2019). Where there is an unexplained "analytical gap between the supposed data relied on by [the expert] and the opinion proffered," it is not admissible. *Olive v. Gen. Nutrition Centers, Inc.,* 30 Cal. App. 5th 804, 820 (2018). Where the expert failed to review and account for obviously relevant facts, the opinion was tossed out. *Prop. California SCJLW One Corp. v. Leamy,* 25 Cal. App. 5th 1155, 1163–64 (2018). See also, e.g., *Wicks v. Antelope Valley Healthcare Dist.*, 49 Cal. App. 5th 866, 880 (2020) (failed to provide reasoned basis for opinion); *McAlpine v. Norman*, 51 Cal. App. 5th 933, 939 (2020) (testimony which is only "ultimate facts and conclusions that are unsupported by factual detail and reasoned explanation" is inadmissible). Where the expert failed to account for facts unique to the patient, the medical opinion was properly rejected. *Alexander v. Scripps Mem'l Hosp. La Jolla,* 23 Cal. App. 5th 206, 229 (2018).

In some cases, the problem is that the expert relies on unreliable materials concerning the facts of the case, which may mean there's an insufficient foundation for opinion. For example, in *San Francisco Print Media Company v. Hearst Corporation,* 44 Cal.App.5th 952 (2020), the expert relied on another person's report with an unclear meaning, and which was unreliable, so the expert opinion in a summary judgment motion context was inadmissible. (In *San Francisco Print Media*, a different factual basis for the expert opinion had previously been disclaimed by the plaintiff—so the defense did no discovery on it—thereby precluding its use by the plaintiff's expert. 44 Cal. App. 5th at 966 & n.9.) The expert in *Sargon* relied on speculation about the company's performance; by contrast, the expert in *Hewlett-Packard* "relied on past data to explain his conclusions regarding Itanium's predicted market share and provided a "logical basis to infer" that his conclusions were supported." *Hewlett-Packard Co. v. Oracle Corp*., 65 Cal.App.5th 506, 572 (2021).

2.8.1 Gatekeeper procedure.

Judges implement *Sargon* in essentially two procedural contexts. One is in law and motion—motions heard not in connection with trial—and the other is pretrial, usually as an in limine motion for exclusion. The usual law and motion proceedings are class action certification motions and summary judgment or adjudication. Sometimes expert testimony is presented on motions for attorney fees; and in some motions relating to venue, expert testimony on foreign law might be presented. *Sargon* arose from a pretrial proceeding in which the redoubtable trial judge spent eight days hearing the expert issue. *Sargon* 55 Cal.4th at 755. Mostly, trial judges don't have that sort of time, and certainly in the law and motion context no hearing time will be allocated except for oral argument; witnesses will not testify in the courtroom except in the most extraordinary circumstances.[19]

[19] Oral testimony must be formally sought at least three days in advance. CRC 3.1306 (b).

Pretrial, the judge has more flexibility and where it is important to have the expert testify live, this can be arranged. Evid. C. 402. But even so, having the expert testify twice, once before the jury is selected and once afterwards, is expensive and cumbersome, and most judges will try to avoid it. With proper expert discovery including the depositions, and the availability of declarations, it should be possible to attack and defend an expert on paper, addressing the key *Sargon* issues without the need for live testimony.

> Comment. To be sure, attacking parties often ask for the 402 hearings but the motivations are mixed, and often include the desire to drive up costs for the other side and have as many bites of the proverbial apple as possible. Judges may wish to have parties seeking a 402 hearing specify precisely why they need it, the issues involved, and why the materials needed to for adjudication could not have been gathered during discovery and presented on paper. Perhaps, using the analogy to the requirements that parties seeking expert depositions pay the expert's fees and costs, parties demanding a 402 hearing do the same, but there is some doubt here.[20]

Law and motion may arise before the time for expert discovery, however. So expert declarations must 'carry their own water' as it were, i.e. they must contain everything the judge needs to find that the expert has the requisite expertise, non-speculative bases for the theory he desires to apply, and the facts of the case to which he will apply the theory, and otherwise as needed to support the opinion. This foundation may include declarations from other experts and percipient witnesses the validity of which the prime expert assumes.

The rules on evaluating experts may be somewhat different in law and motion than they are at trial, at least when it comes to summary judgment and summary adjudication. As result of the general approach to make reasonable inferences in favor of parties defending against summary judgment and against the parties bringing such motions, it was held in *Garrett v. Howmedica Osteonics Corp*., 214 Cal.App.4th 173, 189 (2013) that expert declarations defending *against* the motion ought to have been admitted when arguably they failed to detail the basis for the opinion.[21] *Garrett* plainly carves out a different rule for admissibility in the summary judgment context than for other contexts, and other courts have declined to expand its rationale. So in *Apple Inc. v. Superior Court,* 19 Cal.App.5th 1101, 1119 n.3 (2018), the court expressly refused to follow the case, plainly announcing that "There is only one standard for admissibility of expert opinion evidence in California, and *Sargon* describes that standard." *Apple*, 19 Cal.App.5th at 1119. And a more recent case declined to follow *Garrett* in the same procedural context, i.e., evaluating experts in the summary judgment context. *Fernandez v. Alexander,* 31 Cal.App.5th 770, 782 (2019). As of this writing, none of the 28 published state cases citing *Garrett* has required admission of an expert declaration on the basis of an admissibility rule special to the summary judgment context.[22]

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[20] Those costs might possibly be recoverable after trial. *Hanna v. Mercedes-Benz USA, LLC,* 36 Cal.App.5th 493, 512 (2019) (Song Beverley Act). But usually they are not recoverable. CCP 1033.5 (b) (1).

[21] *Garrett* is described as a case in which "the expert's reasoning was not sufficiently fleshed out." *Shiffer v. CBS Corp.*, 240 Cal.App.4th 246, 254 (2015).

[22] The rule in favor of a 'liberal' reading of evidence opposing summary judgment is not, I suggest, a rule of evidence at all; there is after all only one Evidence Code and as *Apple* says, only one way expert admissibility is handled in state courts. The 'liberal' reading rule is rather just a recognition that at trial the jury will be able to make inferences across a broad scope, based on both defense and plaintiff evidence, and a case can only be taken away from the jury—summary judgment can only be granted—if no jury could reasonably find in favor of the party

The *Garrett* rule, which we might describe as one of liberal admissibility, does not apply when the judge is deciding whether or not to admit the expert opinion at trial. *Michaels v. Greenberg Traurig, LLP*, 62 Cal. App. 5th 512, 524 (2021) (as opposed to the *Garrett* approach, at "a motion in limine before a court or a jury trial, the trial court does not view the evidence in the light favoring either party").

Further discussion of experts in summary judgment and class certification motions is provided at section 3 below.

2.8.2 Tacit Expertise

It is possible that not all admissible expert opinion can be evaluated under *Sargon*. The requirements of a logical – and articulable -- connection among general and specific theories, the specific facts of the case, and the opinion, cannot easily be applied to areas of tacit expertise.[23] Yet we recognize such areas. The expert who immediately knows a statue offered to the Getty museum for $10 million as a fake, the baseball player who knows how to hit a fastball, the professional Go player, judgments by artists—indeed, many judgments by judges—are all at least in part based on tacit expertise. So are some decisions of administrative agencies.[24] *Sargon's* high premium on the articulation of the logic, or steps, which an expert uses to get from her premises to her conclusions cannot be satisfied by most tacit experts. They just know: tested by success in the world, based on perhaps decades of experience, their opinions are reliable. They really have the requisite "special knowledge, skill, experience, training, or education." But they may not be able to tell us why or exactly how they reached their opinions.

No known case addresses this problem.

2.9 *Sanchez* and hearsay.

In 2016 the California Supreme Court put an end to a hypocritical practice endemic in state courts. (The 2016 opinion changed the law. *People v. Perez,* 9 Cal.5th 1 (2020).) In 2016 as now, experts relied on hearsay—indeed, that is written into the statute. Evid. C. 801 (b) ("whether or not admissible"). In the past, courts routinely allowed experts to recite the hearsay bases to the jury in order to buttress their opinions, and courts allowed this under the notion that it was not coming in "for the truth" and so was not hearsay, because it was only coming in to allow the jury to understand the expert opinion. At the same time, judges would instruct the jury that they should consider whether the facts relied on by the experts were true. E.g., CACI 219. Obviously if an expert assumed a car was travelling at a certain speed and this was not true, the jury should disregard the dependent opinion. That is, the factual bases for expert opinion are *always* coming in for the truth.[25] This duplicitous practice was eliminated by *People*

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opposing the motion. But these inferences are, of course, *based on admissible evidence*. If a declaration would not make it past the judge at trial, it should not make it past the judge on summary judgment.

[23] This is based on a more extensive discussion in my article, "The Opinion of Machines," 19 COLUM. SCI. & TECH. L. REV. 136, 166 (2017), *updated in* CAMBRIDGE HANDBOOK OF THE LAW OF ALGORITHMS (2020). On tacit expertise, see generally e.g., Daniel Kahneman, THINKING, FAST AND SLOW 234 ff. (2011); and e.g. Duncan J. Watts, EVERYTHING IS OBVIOUS at 8 *et passim* (2011).

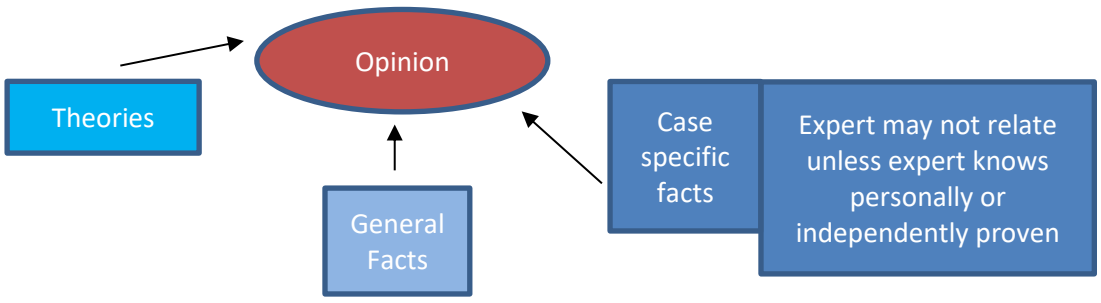
[24] E.g., Jacob Gersen & Adrian Vermeule, "Thin Rationality Review," 114 MICH. L. REV. 1355, 1357–58 (2016).

[25] Justice Mark Simons pointed this out five years earlier. M. Simons, "Introducing Hearsay Through an Expert: Is the Backdoor Closing?," 20 ABTL REPORTER 1 (Summer 2011).

v. Sanchez, 63 Cal.4th 665 (2016).[26] The opinion decided nothing about the statutorily permitted practice of *relying* on hearsay, but it barred experts from *reciting* 'case specific' hearsay to the jury. If the jury needs to hear the case specific facts, they must either come in through some hearsay exception—which does not include expert recitation—or witnesses with non-hearsay evidence must be presented.

As intimated, the case distinguishes between (i) case specific and (ii) non-case specific facts and background. The first is subject to strict application of the hearsay rule; the second is not (this second rule leads to some interesting problems discussed below). "Sanchez accommodates the pragmatic reality that, by dint of what experts do—they draw upon training in, experience with, and study of knowledge produced by others—this special category of witnesses must of necessity rely on hearsay sources." *Strobel v. Johnson & Johnson*, 69 Cal.App.5th 34, 817 (2021) review filed (Nov. 1, 2021).

So for example in a car accident case the case specific facts are those unique to the case: the injuries, whether the light was red or green, the tire marks on the street, and generally what happened. Non-case specific facts are those that are true whether the accident happened or not, such as general background, the expert's general knowledge, the theories about force and mass, perhaps the way traffic lights generally work (although not testimony on the specific lights at issue in the case), and so on. Non-case specific facts are that the usual body temperature is 98.6 degrees, that a street gang uses a distinctive diamond sign on their necks, that the human leg includes a femur, and how an instrument landing system (ILS) generally works. All these things the expert can recite to the jury consistent with *Sanchez*. But she may not recite the temperature of the body found at the scene of the crash, that Bob Jones had a distinct mark on his neck, that surgery revealed a triple boned femur (yes, that's fictive), or what the ILS instruments showed as a plane landed on a specified occasion. See e.g., *People v. Turner*, 10 Cal. 5th 786, 821–22 (2020) (doctor recited facts about gestational age and weight obtained only from the autopsy report, presented them to the jury as true, and represented that those facts bolstered her opinion: this was case-specific hearsay).



We must be careful: even facts which appear to relate to the facts of the case may not "case-specific." For example, admissible non-case specific hearsay includes the pills at issue in *People v. Veamatahau*, 9 Cal.5th 16, 27 (2020), and--even though these refer to the kind of asbestos in a specific asbestos case--"various published materials from government agencies and professional standard-setting groups,

[26] Although the case was a criminal matter, the hearsay principles apply in *all* cases governed by California's Evidence Code. The author Justice Corrigan has said so repeatedly at conferences, and other cases make the point. E.g., *People v. Burroughs*, 6 Cal.App.5th 378, 405 n.6 (2016). See also, M. Simons, CALIFORNIA EVIDENCE MANUAL § 4:31 (2020) (applies to all civil, and other types of, cases). Anyway, "hearsay is hearsay," *People v. Clay* (Cal. Ct. App., May 13, 2015, No. B251482) 2015 WL 2263861, at *19.

published academic articles, published reports of "historical" testing, as well as testing data from their own labs." *Strobel v. Johnson & Johnson*, 69 Cal.App.5th 34, 822–823 (2021), review filed (Nov. 1, 2021) (notes omitted); see id. at 825: documents the expert "relies upon are specific to the defendant (J&J) and to the accused product (JBP) in this case, but that alone does not make them case-specific hearsay…."

2.9.1 Opinions without relaying case-specific evidence

Consistent with *Sanchez*, an expert may opine, generally state the source of the information he's relying on, and otherwise remain silent on case specific evidence. Is the opinion admissible? *People v. McVey*, 24 Cal. App. 5th 405, 417 (2018) holds that opinion is irrelevant as it has no apparent bases, and so is inadmissible. As Justice Simons notes, that conclusion is "debatable. But unless and until either the Supreme Court or a Court of Appeal issues a contrary ruling, *McVey* governs rulings in the trial court." SIMONS CALIFORNIA EVIDENCE MANUAL § 4:31 (2022). As of June 2022, there is no published case agreeing or disagreeing with *McVey* on this issue.

The specific problem here seems to be that the opinion is inadmissible as not "helpful" to the jury because the jury "must decide whether information on which the expert relied was true and accurate." CALCRIM 332; CACI 219. See also, e.g*., Cooper v. Takeda Pharm. Am., Inc.,* 239 Cal. App. 4th 555, 577 (2015) ("expert opinion may not be based on assumptions of fact that are without evidentiary support…. Therefore, an expert's opinion that something could be true if certain assumed facts are true, without any foundation for concluding those assumed facts exist in the case before the jury, does not provide assistance to the jury") (internal quotes and citations omitted). Note that this problem is not eliminated even if there are other non-hearsay sources of the evidence; the expert should also tell the jury that the expert relied on that evidence.

Finally, but importantly, recall that an expert's opinion may be admissible if it rests on reliable—but not admissible—facts. *Zuniga v. Alexandria Care Center, LLC*, 67 Cal.App.5th 871 (2021). Here, the expert relied on spreadsheets which the trial judge reasonably held were inadmissible. *Id*. at 885. But the trial judge was wrong when he then disallowed expert testimony founded on the spreadsheets, because (i) experts can always rely on inadmissible materials, if they are reliable (as *Sargon* tells us, 55 Cal.4th at 770-772), and here (ii) the spreadsheets were reliable. *Id*. at 887. Interestingly, and perhaps crucially, this was a bench trial, so the finder of fact here—the judge—had access to the inadmissible spreadsheets and could therefore consider (if he had wanted to) whether they were reliable and whether they supported the expert opinion. *Zuniga* leaves unasked, and unanswered, what to do in a jury trial.

2.9.2 Minimizing the Burden of Compliance with *Sanchez*.

Without advanced planning *Sanchez* may create additional burden at trial, e.g., calling in an array of witnesses to establish case specific facts. With advanced planning, some good will and professionalism on both sides, much of this additional burden can be eliminated.

First, of course, lawyers should stipulate to as many facts as possible. It's true that creating stipulations in anything but the simplest trial can be exhausting and time consuming, but it may be worth the candle if it entirely eliminates the need for some witnesses. This is a good opportunity for deal making: both sides can benefit. When it comes to experts, the burden may not be as great as feared, because good

expert reports make explicit exactly which facts are assumed or understood or relied on by an expert, and the parties can stipulate to exactly those facts (or whatever subset are not honestly in dispute).

Second, parties should stipulate to federal rule of evidence (FRE) 1006. The rule is a blindingly obvious way to reduce burden and prejudices no one; it is unclear why California has not yet adopted it as part of its Evidence Code. In any event, parties can take matters into their own hands and agree to the rule, which reads, in its entirety:

> The proponent may use a summary, chart, or calculation to prove the content of voluminous writings, recordings, or photographs that cannot be conveniently examined in court. The proponent must make the originals or duplicates available for examination or copying, or both, by other parties at a reasonable time and place. And the court may order the proponent to produce them in court.

As the accompanying note tartly observes, "The admission of summaries of voluminous books, records, or documents offers the only practicable means of making their contents available to judge and jury."

Third, the parties may be able to take advantage of Evid. C. § 1340 which reads,

> Evidence of a statement, other than an opinion, contained in a tabulation, list, directory, register, or other published compilation is not made inadmissible by the hearsay rule if the compilation is generally used and relied upon as accurate in the course of a business as defined in Section 1270.

See e.g., *Collins v. Navistar, Inc.,* 214 Cal.App.4th 1486, 1516 (2013) (traffic accident statistics).

2.9.3 *Sanchez* implications.

As it solves one issue, *Sanchez* creates others. I outline two here: first the 'new hearsay exception' issue; and second, what I term the 'generalization problem'.

2.9.3.1 New hearsay exception.

Under *Sanchez* the expert may relate to the jury general background, i.e. facts which are true regardless of the existence of the case, which would be true in any case: "experts may relate information acquired through their training and experience, even though that information may have been derived from conversations with others, lectures, study of learned treatises, etc.," *Sanchez*, 63 Cal.4th at 675. *Sanchez* makes it clear that this material is coming in for the truth (because its accuracy is a predicate of the opinion, and the jury evaluates that accuracy as it decides whether or not to accept the opinion, 63 Cal.4th at 675[27]), so we no longer pretend otherwise. But there is a vast range of materials that can come in this way, for the truth. Studies, surveys, and all manner of literature may thusly be recited by the expert to the jury, as long as these are non-case specific materials the expert actually relies on and they are "of a type that reasonably may be relied upon by an expert in forming an opinion upon the subject to which his testimony relates." Evid. C. 801 (b). *Sanchez* announced a new rule, *In re Ruedas*, 23

[27] See also a discussion of this rationale at e.g., *In re Ruedas*, 23 Cal.App.5th 777, 790 (2018).

Cal.App.5th 777, 797 (2018),[28] and part of that rule is a new and potentially expansive type of hearsay exception.

The trial court retains discretion to limit the recitation of hearsay, especially when the "expert" is just being used as a conduit for hearsay. *People v. Veamatahau*, 9 Cal.5th 16 (2020). Compare *People v. Thompkins*, 50 Cal. App. 5th 365, 408–717 (2020), where the expert was allowed to recite background information perhaps "from multiple sources" which he had "organized, mentally at least," having "used his expertise to evaluate the reliability of information he received." Thus he did not "simply 'regurgitate' prior conviction information."

2.9.3.2 The Generalization Problem.

Assume that "Z Brand" pills are blue, oval, with three red dots. These are widely understood to be indicia of a certain illegal drug (e.g. they contain a version of OxyContin combined with methamphetamine), as experts in the field agree. A defendant is arrested with such pills in her possession. While the details of the arrest, including a description of the pills found on the defendant, are of course case specific, the prosecution says the illegal nature of the drug can be testified to by an expert, because the fact that pills which are blue, oval, with three red dots are illegal drugs is true irrespective of the facts of this case. The defense retorts that the testimony obviously goes to the content of the pills found on defendant, so the matter is case specific.

Cases had gone both ways on this issue. In *People v. Stamps*, 3 Cal.App.5th 988, 996 (2016) the content of a web site known as Ident–A–Drug which described the content of pills apparently identical to those in defendant's possession was hearsay and was also termed case specific: "We think it undeniable that the chemical composition of the pills Stamps possessed must be considered case-specific." 3 Cal App. 5th at 997. A different division of the same court went the other way. "The information in the database …was not about the specific pills seized from defendant, but generally about what pills containing certain chemicals look like." *People v. Veamatahau*, 24 Cal.App.5th 68, 74–75 (2018) (*citing Sanchez*), superseded by 9 Cal.5th 16 (2020). Another case avoided the issue and found a different basis for admission, *People v. Espinoza*, 23 Cal.App.5th 317, 322 (2018) ("The testimony established that it was an authoritative published compilation of generic drug data used by criminalists," citing Evid. C. 1340); accord, *People v. Mooring*, 15 Cal.App.5th 928, 940 (2017).

The Supreme Court has resolved the issue, siding with the court of appeal in *Veamatahau* and disapproving *Stamps*. *People v. Veamatahau*, 9 Cal.5th 16 (2020).

This points to a larger issue, which is the extent to which generalizations concerning products—products at issue in a case—are case specific. These generalizations are case specific in the sense that they obviously relate to the items in the case, but they are not case specific in the sense that they are true without regard to whether (i) the case was brought or (ii) the facts leading to it ever took place. For example, assume a product liability case involving Ford's Model 780 truck (a fictive item). The brakes allegedly failed and injured the plaintiff. An expert testifies that the Model 780 has defective brakes: this is known generally to experts in the field, and is true irrespective of the experiences of the plaintiff in this case. It is not clear if this is case specific or not, and the issue extends indeed to any statements which can been seen as a generalization about a product.

[28] Typically courts are not permitted to create new rules of evidence, at least such as privileges. *OXY Resources California LLC v. Superior Court*, 115 Cal.App.4th 874, 888–889 (2004).

2.10 The *Cooper* Problem: The Use of Reports and Studies

The case of *Cooper v. Takeda Pharmaceuticals America, Inc*., 239 Cal.App.4th 555 (2015) raises difficult issues concerning the role of the judge, who acts as a gatekeeper to keep out unreliable expert testimony, and that of the jury, which evaluates the testimony for credibility and weight, which also of necessity involves an evaluation of reliability. This will point to difficulties in understanding what 'reliability' means in certain areas of scientific expert testimony and who is best suited to decide it.

Many experts do not rely on studies and reports, and this section does not apply to them. For example, it is not pertinent to experts such as those in "drug terms, handwriting analysis, criminal *modus operandi,* land valuation, agricultural practices, railroad procedures, attorney's fee valuation, and others." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 150 (1999) (alluding to descriptions from the Brief for United States as *Amicus Curiae*).

Throughout this discussion, which focuses on scientific opinion such as that a chemical or substance causes a disease, it is important to recall that once a judge admits an opinion, it will be difficult if not impossible to upend a verdict based on it, such as on a motion for a new trial or judgment notwithstanding the verdict. Once the issue is handed off to the jury, the jury is entitled to give the opinion little or no weight—or decisive weight. To put this in colloquial terms: if a weak, clumsy, poorly reasoned opinion nevertheless overcomes the basic hurdle of admissibility,[29] on the basis for example that its weaknesses can be attacked on cross examination and countered by opposing opinions, then a verdict consistent with it (including both substantial compensatory and punitive damages) will likely survive.

In *Cooper* the trial judge was reversed for a couple of distinct reasons,[30] but I focus only on one here, which that the judge was faulted for striking an expert opinion, done after the experienced judge had exhaustively examined the various studies which underlay the opinion and found them either (i) unreliable or (ii) not supportive of the opinion, seemingly exactly the task the judge was assigned by *Sargon*. The expert opinion was that a drug known as "Actos" caused bladder cancer. The jury found for plaintiff but the trial judge vacated the award because he found he should not have admitted the foundational opinion on medical causation. *Cooper*, 239 Cal.App.4th at 571. The judge reviewed the relevant studies and found each unreliable because, e.g., the expert himself had said some were unreliable, with data that had to be viewed with great caution, 239 Cal App. 4th at 587. In another example, the report's authors had "changed methodology after beginning the study, and the positive association in the study came only after the authors excluded 250,000 of the original patients; in the study as originally conceived, no significant association was found." Id. at 587. Another study was rejected because –and this in a case where the plaintiff's smoking was central to the causation dispute—the "authors admitted the research database they used lacked data on other occupational exposures, race, and family history of bladder cancer. The Azoulay study also did not control for smoking

[29] The following quotation, taken out of context, suggests that very weak evidence indeed might be admissible: "A jury may repose greater confidence in an expert who relies upon well-established scientific principles. It may accord less weight to the views of an expert who relies on a single article from an obscure journal or on a lone experiment whose results cannot be replicated." *People v. Sanchez*, 63 Cal. 4th 665, 686 (2016).

[30] E.g., the judge "misapprehended the substantial factor test," *Cooper*, 239 Cal.App.4th at 577.

based on the number of years the subject smoked, when they smoked, or how much they smoked." 239 Cal.App.4th at 588. And so on. The appellate court reversed:

> [T]he validity of these studies, and both their strengths and their weaknesses, are subject to considerable scientific interpretation and debate. The trial court abused its discretion by essentially stepping in and resolving the debate over the validity of the studies. In particular, the trial court's piecemeal rejection of individual studies was inappropriate and ignored the testimony by Drs. Neugut and Smith that the results of the individual studies considered as a whole, including in the meta-analyses, was what really persuaded them that Actos® causes bladder cancer. All studies have limitations and flaws, and it is entirely valid to interpret each study's results by taking into account these limitations and flaws. However, it is essential that the results of other studies conducted by other scientists on the same subject, that aim to correct for the limitations and flaws in prior studies, be taken into account, and the body of studies be considered as a whole. As Dr. Neugut testified, any one study can be criticized, but if most studies consistently reach a similar answer, that gives confidence to an epidemiologist that the answer is correct.

Cooper, 239 Cal.App.4th at 589–590 (note omitted). The court of appeal pointedly noted the fame and high reputation of the expert. 239 Cal.App.4th at 591.

The Ninth Circuit did something similar in *Wendell v. GlaxoSmithKline LLC*, 858 F.3d 1227, 1233 (9th Cir. 2017) where it noted the high qualifications of the experts and criticized the analysis of the underlying studies by the trial judge. 858 F.3d at 1235–1236. As long as the studies were not "junk science" the court held, it was up to the jury, which would have "vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof," to decide the extent to accept the opinion. 858 F.3d at 1237 (internal quotes omitted).[31]

Both *Cooper* and *Wendell* seem to set a low bar for the judge's gatekeeper role: as long as the matter underlying the opinion is not junk,[32] or if a series of studies together, each of which has problems, in the expert's opinion together support his opinion, then the opinion must be admitted. It will be the jury's role to evaluate the "validity of these studies, and both their strengths and their weaknesses, [which] are subject to considerable scientific interpretation and debate." See also e.g., *Johnson & Johnson Talcum Powder Cases,* 37 Cal.App.5th 292, 326 (2019) (relying on *Cooper*, reversing trial judge's

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[31] *Wendell* was invoked in *Hardeman v. Monsanto Company*, 997 F.3d 941, 967 (9th Cir. 2021), pet. cert. filed Aug. 18, 2021. The appellate court noted a series of issues with various studies, e.g., id. at n. 16, id. at *14 & nn.14 and 15 (bias, recall bias; confounding variable). But relying significantly on epidemiological evidence, id. at *17, the court affirmed the trial court's admission of expert testimony on general and specific causation to link Roundup's glyphosate to the plaintiff's non-Hodgkin's lymphoma. The court cited *Wendell* to the effect that district courts should not look "too narrowly at each individual consideration, without taking into account the broader picture of the experts' overall methodology". Id. at *15 n.16. The court cited *Wendell's* reference to *Daubert's* suggestion that the "interests of justice favor leaving difficult issues in the hands of the jury and relying on the safeguards of the adversary system ... to 'attack[ ] shaky but admissible evidence." Id. at *12 (internal quotations omitted). I detail doubts that the "interests of justice" are truly served by these features of the adversarial system in my "Scientific Evidence: Grand Theories And Basic Methods," CORNELL L.REV. (online) (forthcoming), preprint at https://works.bepress.com/curtis_karnow/53/

[32] Other cases too describe judges' *Sargon/Daubert* gatekeeper job as simply keeping out "junk science." E.g., *Domingo ex rel. Domingo v. T.K.*, 289 F.3d 600, 605 (9th Cir. 2002); *Sardis v. Overhead Door Corporation*, 10 F.4th 268, 275 (4th Cir. 2021)

exclusion of opinion because among other things the studies relied on by expert were not "categorically irrelevant" and so "jury could accept [expert's] explanations" why studies were pertinent). An unpublished opinion nicely sets out this view of the jury's role:

> Ultimately, the fact that other peer-reviewed studies reach contrary conclusions, call for further research, or were conducted under circumstances in certain ways distinguishable from those at hand, does not render an expert opinion speculative or baseless. Rather, these facts are relevant to the probative weight of the opinion, which remains a matter for the jury rather than this court. (*Kelley v. Trunk* (1998) 66 Cal.App.4th 519, 524, 78 Cal.Rptr.2d 122 [when competent experts present opposing opinions, the jury must decide "[w]hich expert opinion [i]s correct"].)

Shelby v. SeaRiver Maritime Inc. 2011 WL 576569, at *10 (Feb. 18, 2011, No. A122449) (note omitted). This sentiment is common. E.g. *Schultz v. Akzo Nobel Paints, LLC,* 721 F.3d 426, 433 (7th Cir. 2013) ("Both experts were entitled to present their views, and *the merits and demerits of each study can be explored at trial*") (emphasis supplied). See also e.g., *Daubert v. Merrell Dow Pharms., Inc.,* 509 U.S. 579, 596 (1993)("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").

This approach leads to a few interesting problems. First, we may ask: where exactly is the expertise which is being evaluated in these circumstances? Second, does the jury get to see all the underlying studies and reports? Third, how do we handle the issue of what has been termed 'bad science,' i.e., 'science' with all the appearances of serious, ordinary scientific work but which is in fact fallacious?

2.10.1 Locus of expertise.

In most trials when experts premise their opinions on reports and studies, it is not the testifying witnesses who did the studies. Rather, the expert is familiar with someone else's studies and believes them to be reliable. What then, is the expert opinion which the jury is asked to endorse or reject? In one sense it is the testifying witness, at least in a general way, who nominally has collected the studies, evaluated them, and as an expert believes them worthy. This is probably the reason the appellate courts in both *Cooper* and *Wendell* emphasized the credentials of the testifying witnesses: their judgments (on how good the reports were) should have been credited by the trial judge who, after all, knows nothing of the substantive area.

But this seems odd: Many experts do not have an opinion except to the extent it was established by the reports they relied on. They might have had expertise in knowing a good report when they see it, but (1) lay people such as judges might have the tools to do that too, and (2) that sort of expertise—knowing a good report—is not usually the area of expertise for which they are advertised. Their core opinion is something else, i.e., that chemical X causes cancer. And that's extracted from the *studies*.

The issue may not seem to be serious, because after all as *Sanchez* itself makes express, all experts rely on foundations of knowledge accumulated by others, and it is a waste of time to distinguish for example an expert astronomer's personal understanding of optics from that derived from Galileo. Virtually all general foundational knowledge is in this sense indistinguishable from the knowledge of the testifying witnesses. But the situation here is somewhat different. The reports and studies showing chemical X causes cancer are not general or foundational, or, usually, commonly accepted in the discipline (because

there is a scientific controversy). *They are themselves often the specific opinion which a party wants a jury to accept or reject*. They convey the opinion of other scientists—who are not testifying and not available for cross examination. Unfortunately, this is not a bright line issue: in many lawsuits it will be ambiguous the extent to which the testifying expert is relaying other opinions and the extent to which she has synthesized materials to create, and truly be the author of, her own opinion. To the extent it is the former, it is not admissible. *Stephen v. Ford Motor Co*., 134 Cal. App. 4th 1363, 1375 (2005), citing *Whitfield v. Roth,* 10 Cal.3d 874, 895 (1974) ("expert may testify about and explain the basis for his opinion, but this rule does not mean the testifying expert can become a channel for the opinions of the non-testifying experts on whom he relies"); *People ex rel. Dep't of State Hosps. v. S.M.*, 40 Cal. App. 5th 432, 442–43 (2019) ("An expert witness may not, on direct examination, reveal the content of reports prepared or opinions expressed by nontestifying experts…. The reason for this is obvious. The opportunity of cross-examining the other doctors as to the basis for their opinion, etc., is denied the party as to whom the testimony is adverse") (internal quotations omitted). See also *People v. Veamatahau*, 9 Cal.5th 16, 34 (2020) (court may exclude testimony "based entirely upon or substantially upon other opinions," quoting *Mosesian v. Pennwalt Corp.*, 191 Cal.App.3d 851, 862 (1987)); *Strobel v. Johnson & Johnson*, 69 Cal.App.5th 34, 822, 827-28 (2021) review filed (Nov. 1, 2021).

In some cases, the expert is indeed the person who conducted the research, in which case the problem does not arise.

> Comment. It may be helpful to consider (i) what sort of cross examination would be pertinent, (ii) whether the expert's area of expertise is in fact in the area of the reports and studies, and (iii) whether virtually anyone could have been offered as the witnesses. As to (i), one asks what it is that the witnesses 'brings to the table'- the extent to which the witness' views and opinions, as opposed to those in studies, are being pressed on the jury. If a devastating cross examination of the witnesses would still leave much or all of the opinion untouched or conversely if the witness is essentially unimpeachable but the opinions could simply be rejected for other reasons, then perhaps the witnesses is not truly the source of the opinion. As to (ii), one might compare the (a) specific expertise of the witness and (b) scope needed to render the opinion. For example, consider epidemiological reports suggesting chemical X causes bladder cancer. In one situation, the testifying witnesses is an epidemiologist, and in another, the witness is a doctor who treats bladder cancer. It is more likely that in the second situation the opinion is not in a meaningful way that of the witnesses, even though his expertise vaguely sounds relevant. As to (iii), one might consider the universe of people who could have provided the testimony based on studies and reports. The larger the universe, the less likely it is that the witness' expertise is being offered. At one end of the spectrum, the witness is simply someone with a Ph.D. who testifies she is familiar with reports and studies, and has enough chemistry training to understand and explain the content of the reports. There, it is unlikely it is her expertise which in any material way is being offered to the jury. At the other end of the spectrum of course is the unique author of the report.

2.10.2 The hearsay problem.

First, an aside on hearsay. Part of the problem of admitting reports—at least on direct examination when not done for purposes of impeachment, as it usually is on cross examination—is that the studies are hearsay. But because the studies are not case specific, they may be the sort of thing experts in the area rely on. So *Sanchez* may authorize their admission because they are not "particular events and participants alleged to have been involved in the case being tried." *Sanchez*, 63 Cal. 4th at 676. No

known case takes this approach, and it would counter a good deal of precedent warning of the hearsay dangers. *Continental Airlines, Inc. v. McDonnell Douglas Corp.* 216 Cal.App.3d 388, 415 (1989); M. Simons, CALIFORNIA EVIDENCE MANUAL § 4:23. But it is unclear why *Sanchez* does not have this effect.

> Comment. Perhaps in the future the bifurcated world *Sanchez* seems to envision—comprising case specific facts and non-case specific facts—will mutate and produce a third category where admissibility is function of other criteria. One candidate is Evid. C. 352 and the related criteria of reliability. Section 352 permits the exclusion of relevant evidence if the prejudice clearly outweighs probative value; and prejudice includes waste of time as well as the risk of misleading the jury. Thus a judge might allow the studies in except to the extent that that there are too many or they are too voluminous and it would take an inordinate amount of time on direct and cross. The 352 approach is that used in federal courts:
>
> > An expert may base an opinion on facts or data in the case that the expert has been made aware of or personally observed. If experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject, they need not be admissible for the opinion to be admitted. But if the facts or data would otherwise be inadmissible, the proponent of the opinion may disclose them to the jury only if their probative value in helping the jury evaluate the opinion substantially outweighs their prejudicial effect.
>
> FRE 703. See CALIFORNIA PRACTICE GUIDE: FEDERAL CIVIL TRIALS & EVIDENCE ¶¶ 8:1577.1 *ff*., 11:7 (Rutter: 2019); *U.S. v. W.R. Grace*, 504 F.3d 745, 761 (9th Cir. 2007); *Black v. M & W Gear Co.*, 269 F.3d 1220, 1229 (10th Cir. 2001). The last sentence of rule 703 closely tracks California's § 352.[33]

2.10.3 Viewing underlying studies.

The trial judges in *Cooper* and *Wendell* certainly got to see the underlying reports, and if "their strengths and their weaknesses" are to be the subject of deliberations in the jury room, surely the jury too must have them to review. But current law does not seem to endorse this, and my entirely unscientific survey of a few federal and state judges suggests that, at least where there is an objection, judges do not usually admit underlying reports and studies when an expert is testifying on direct, although most allow portions on cross examination (see Evid. C. 721). "An expert witness may not, on direct examination, reveal the content of reports prepared or opinions expressed by non-testifying experts… This rule does not preclude the cross-examination of an expert witness on the content of such reports." *People v. Campos*, 32 CA4th 304, 308 (1995).

Traditionally in both federal and state courts around the country, at least on direct examination of an expert, the judge won't admit the studies and reports on which the opinion on is based.[34] In federal

[33] "The court in its discretion may exclude evidence if its probative value is substantially outweighed by the probability that its admission will (a) necessitate undue consumption of time or (b) create substantial danger of undue prejudice, of confusing the issues, or of misleading the jury." Evid. C. § 352.

[34] This has been the common rule. Ronald L. Carlson, "Experts, Judges, and Commentators: The Underlying Debate about an Expert's Underlying Data," 47 MERCED L.REV. 481, 483 (1996) available at: https://digitalcommons.law.uga.edu/fac_artchop/301

court, there's a presumption against this admission, although the judge can admit the reports, using a prejudice/probative weighing similar to California's Evidence Code 352 balancing test.[35]

In California courts, "An expert witness may not, on direct examination, reveal the content of reports prepared or opinions expressed by non-testifying experts."[36] The rationale of course is that these reports and studies are hearsay. The authors of the reports and studies aren't in court to be cross-examined. Based on this hearsay rationale, both state and federal courts allow *cross examination* of the expert on the reports and studies relied on—after all, at that point they aren't coming in for the truth;[37] at least that's the conceit.

The Evidence Code distinguishes between (1) "admitting" publications with them being "read" into evidence and (2) receiving the papers as *exhibits*, which is not permissible. Evid. C. 721(b).[38] Now, this is extremely awkward, because it is really not possible to evaluate most scientific papers just having them read out loud without the physical paper itself in hand; and the time needed to read these papers—together with their graphs and scientific notions and the rest—makes the exercise entirely futile. The Evidence Code probably does not really contemplate this sort of wholesale admission of the studies, but only "relevant portions"–which makes perfect sense from the viewpoint of expedition at trial, but is wholly inadequate if the jury truly is supposed to evaluate the "strengths and their weaknesses" of the papers.

Thus it remains unclear how what I call the *Cooper* rule of having juries pass on the reliability of underlying papers, studies, and reports can actually be effectuated.

2.10.4 Bad science.[39]

The problems of submitting studies and reports to the jury in an effort to educate them on the ultimate reliability of an expert opinion are exacerbated by the fact that much of what passes for valid science is not. True, even under the *Cooper* rule if a study were shown to be 'junk science' the trial judge would (I hope) be upheld if in her gatekeeper role the judge struck an opinion that of necessity relied on the study. But there are many studies which are not exactly junk—they may be published in well-known

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[35] "Direct Examination of Expert Witnesses," PRAC. GUIDE FED. CIV. TRIALS & EV. ¶ 11:7 (Rutter 2020) ("Limitation on disclosure to jury: The party offering the expert's opinion may not ask the expert about inadmissible facts or data relied upon by the expert in forming his or her opinion, except with leave of court. In such cases, the court must determine whether the probative value of the facts or data "in helping the jury evaluate the opinion *substantially outweighs their prejudicial effec*t…. [11:7.1] Presumption against disclosure: The balancing test (¶ 11:7) establishes a *presumption* against disclosure to the jury of otherwise inadmissible evidence. [See Adv. Comm. Notes to 2000 Amendments to FRE 703]".

[36] *People v. Campos*, 32 Cal.App.4th 304, 308 (1995); logic endorsed in *People v. Landau,* 246 Cal.App.4th 850, 870 (2016) ("The reason for this rule is lack of the opportunity to cross-examine the other experts as to the basis for their opinions.")

[37] State law: *People v. Campos*, 32 Cal.App.4th 304, 308 (1995); William E. Wegner et al., "Opinion Evidence," CALIFORNIA PRACTICE GUIDE--CIVIL TRIALS AND EVIDENCE ¶¶ 8:759-8:765.2 (September 2019 Update); M. Simons, "Introducing an official report—Expert testimony," CALIFORNIA EVIDENCE MANUAL § 8:31 (2020). Federal law: "Direct Examination of Expert Witnesses," PRACTICE GUIDE FEDERAL CIVIL TRIALS & EVIDENCE ¶11:8.2 (Rutter), citing FRE 705—"expert may be required to disclose those facts or data on cross-examination;" *Pineda v. Ford Motor Co*., 520 F3d 237, 247 n. 14 (3rd Cir. 2008).

[38] See also FRE 803 (18) ("Learned treatises").

[39] See Ben Goldacre's website https://www.badscience.net/ and his book BAD SCIENCE (2008, 2010).

peer reviewed journals—but they are unreliable. Going through the problems of why one, two, or a dozen papers or studies suffer from some of the 'bad science' infirmities (detailed below) can be enormously time consuming to address to a jury—a jury which typically relies on oral (and aural) and visual presentation, not on a close review of stacks of binders of written reports.

As we consider the criteria which might identify bad science, we can phrase two questions: (1) is the proffered area actually "science"?, and (2) are the reports truly done in a scientifically reliable way? These are not easy questions, and 'common sense' is often a very bad guide, adding to the risk of relegating these issues to the jury. Many sophisticated and intelligent people believe foolish things, such as that scientific studies show childhood inoculations cause autism;[40] and there are claims that seem absurd which actually represent the considered state of the art of a very broad swath of scientists, such as quantum superposition;[41] or that the universe started from nothing in the "big bang".

2.10.4.1 Do the rules help?

In our effort to address scientific validity, we might turn to the basic rules which govern the admissibility of expert opinion. But they will not help. In each case, they only refer us back to the testifying expert; they do not provide an independent vantage from which we might decide if the expert's field is really scientific or her methods and reliance on materials are valid. For example, we are told that experts must use "same level of intellectual rigor that characterizes the practice of an expert in the relevant field." *Kumho Tire* 526 U.S. at 152, quoted by *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747, 772 (2012); see also *Davis v. Honeywell Internat. Inc.,* 245 Cal. App. 4th 477 (2016) (referring us to "standards applicable to his field of expertise"). This refers us to whatever the standard is in the relevant field, a standard to which the expert himself presumably will refer us, and which the expert, himself, will describe; which unsurprisingly will be congruent with the level of rigor the expert in question actually displays. Assume for a moment the "field of expertise" is phrenology or astrology, and it becomes clear how little use this standard is in practice.

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[40] The rumors were started by a discredited "study" by Andrew Wakefield in 1998. https://www.npr.org/2011/01/09/132735944/as-the-facts-win-out-vaccinations-may-too (Wakefield's fraud). See e.g., https://www.chop.edu/centers-programs/vaccine-education-center/vaccines-and-other-conditions/vaccines-autism; http://www.vaccinesafety.edu/vs-autism.htm.; https://www.cdc.gov/vaccinesafety/concerns/autism.html. See generally, Jonathan D. Quick, "The Vaccine-Autism Myth Started 20 Years Ago. Here's Why It Still Endures Today," *Time* (February 28, 2018) https://time.com/5175704/andrew-wakefield-vaccine-autism/; Alfred Lubrano, "Anti-vaccine parents are often white, college-educated, 'Whole Foods moms'" (April 10, 2019), https://www.inquirer.com/news/middle-class-working-class-vaccine-anti-vaxxers-measles-cdc-20190410.html; Seth Mnookin, THE PANIC VIRUS: A TRUE STORY OF MEDICINE, SCIENCE, AND FEAR (2011).

[41] Roughly speaking, a quantum object such as an electron can be in multiple states (e.g. in different positions, have different energies or be moving at different speeds) at the same time, and only 'decohere' into a single observed state at the time of observation. http://www.physics.org/article-questions.asp?id=124. While this sounds (to put it mildly) odd, the notion works: extant quantum computers utilize this feature of quantum objects. Brian Resnick, "Why scientists are so excited about 'quantum supremacy'" (Oct. 24, 2019), https://www.vox.com/science-and-health/2019/10/24/20928714/google-quantum-supremacy-quantum-computers; Procopio, L., Moqanaki, et al., "Experimental superposition of orders of quantum gates," 6 *Nat Commun* 7913 (2015), https://rdcu.be/bZ4KE; Tadrash Shah et al., "Quantum Computing: Fusion of Physics and Computers," *CSI Communications* 28 (February 2015), https://www.researchgate.net/profile/Chintan_Bhatt2/publication/274721829_Quantum_Computing_Fusion_of_Physics_and_Computers/links/5528b8ef0cf2e089a3a5358c/Quantum-Computing-Fusion-of-Physics-and-Computers.pdf

Then there is the rule that an expert's testimony must be based on matter "that is of a type that reasonably may be relied upon by an expert in forming an opinion upon the subject to which his testimony relates." Evid. C. 801(b); see e.g., *Roberti v. Andy's Termite & Pest Control, Inc.*, 113 Cal.App.4th 893, 906 (2003). This presents the same sort of loop: we are to judge if the materials used by an expert are of the sort an expert in that field would rely on, and judges—not being experts in the field—will likely look to the expert to say so. And he will. So too when we wonder whether a text relied on is "authoritative" for cross examination purposes, Evid. C. 712(b)(3), *Paige v. Safeway, Inc.*, 74 Cal. App. 5th 1108, 1124 (2022). It will likely be an expert who informs the court of the fact.

I turn now to the two questions relevant to scientific experts: (1) is the proffered area actually "science"? and the related issue: (2) are the reports truly done in a scientifically reliable way? (Here, I preliminarily separate the questions, but they are in fact two ways of making the same inquiry as I will note below.)

2.10.4.2 What is science?

State law does not articulate much by way of an answer to this question. But without some sense of this it is difficult to bar experts who pretend to science such as phrenologists, those espousing alienism,[42] or as the U.S. Supreme Court noted, practitioners of "astrology or necromancy," *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151 (1999); and it is difficult to evaluate experts in sometimes broad and vaguely defined fields of hypnosis, acupuncture[43] and chiropractic.[44] Without a developed sense of what 'science' and scientific reliability are, we may be unable to articulate an analysis of widely used but baseless tests such as the Myers-Briggs personality tests,[45] or of experts purporting to tell us the impact

[42] [O]nly doctors exercising the new speciality [sic] of alienism could determine whether the accused suffered from this type of madness. To this end, they had to complete the appropriate report based on supposedly objective evidence. Certain physical traits, including the shape of the head, facial expressions, and even body types were interpreted by 19th century alienists as 'stigmata', or evidence of cerebral degeneration. If the judges were convinced, these reports could be decisive in determining if the accused was insane or a true criminal. Discovering a family history of 'neuropathic traits', usually referring to alcoholism, epilepsy, syphilis, or suicide, was a strong argument in favour of a diagnosis of insanity due to cerebral degeneration." S. Giménez-Roldán, "Cerebral degeneration and Spanish alienists in the 19th century: cranial and facial features as explained by expert witnesses," 4 *Neurosciences and History* 1-12 (2016), http://nah.sen.es/vmfiles/abstract/NAHV4N120161_12EN.pdf

[43] Some of this might be effective, either as a placebo effect- or perhaps in addition to that effect. https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/413107. See also https://www.theguardian.com/science/2013/jul/26/acupuncture-sceptics-proof-effective-nhs ("Acupuncture has been prescribed by half of Britain's doctors, but after 3,000 clinical trials its efficacy remains unproven"); https://www.health.harvard.edu/blog/acupuncture-a-point-in-the-right-direction-or-a-stab-in-the-dark-2017050311672 ("Multiple studies have failed to demonstrate any scientific evidence supporting such principles.")

[44] Some practices may be effective and others not. https://time.com/4282617/chiropractor-lower-back-pain/ ("While the strongest evidence in support of chiropractic involves the treatment of back pain, Schneider says there's also evidence for neck pain and some types of non-migraine headaches. Still, his profession is not without controversy, he says. "The controversy comes in when chiropractors make claims about treating non-musculoskeletal conditions"—claims he says have little to no basis in science.")

[45] "The Myers-Briggs Type Indicator is probably the most widely used personality test in the world. About 2 million people take it annually, at the behest of corporate HR departments, colleges, and even government agencies. The company that produces and markets the test makes around $20 million off it each year. The only problem? The test is completely meaningless." https://www.vox.com/2014/7/15/5881947/myers-briggs-personality-test-

of cults on consent.[46] And it can make it difficult to identify those who essentially impersonate mainstream scientists.

2.10.4.2.1 Homeopathy: A case study

Homeopathy presents a nice case posing the issue: Is the area really science? Should we allow homeopathic experts to testify? Homeopathy contends that (1) "Like cures like"—the notion that a disease can be cured by a substance that produces similar symptoms in healthy people; and (2) the 'Law of minimum dose'—the notion that the *lower* the dose of the medication, the *greater* its effectiveness.[47] The treatments do no better than a placebo, i.e., as good as taking a sugar pill thinking it's medicine.[48] Of course, if the homeopathic treatment is taken instead of real medicine, and the condition (e.g. cancer) requires real medicine, the outcome can be fatal.[49] Pursuant to 'law of minimum doses,' the usual dilution is termed "30C," i.e. "that the original substance has been diluted by 1 drop in 100, 30 times…. which means a 1 followed by 60 zeroes, or - let's be absolutely clear - a dilution of 1 in 1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000…. At a homeopathic dilution of 100C, which they sell routinely, and which homeopaths claim is even more powerful than 30C, the treating substance is diluted by more than the total number of atoms in the universe."[50] As the British Homeopathic Association notes, " there may be no molecules of original substance left" in the dose.[51] Many states allow homeopathic prescriptions only by a licensed doctor, probably to guard against the possibly fatal outcome I note above. E.g., *Metzler v. New York State Bd. for Prof'l Med. Conduct*, 203 A.D.2d 617, 618, 610 N.Y.S.2d 334, 335 (1994); *In re Guess*, 327 N.C. 46, 393 S.E.2d 833 (1990).

Homeopathy is not science. Its tenants are speculation, or worse, in the sense that hundreds of studies have not shown them to be valid. Yet some judges have held experts may testify to not just the history of the areas, but to opinions that doses are efficacious. E.g*., Allen et al. v. Hyland's, Inc. et al*., No. 2: 12-cv-01150 (C.D. Cal. Jan. 8, 2016) (ECF No. 446), discussed in Robert G. Knaier, "Homeopathy on Trial: Allen v. Hyland's, Inc. and A Failure of Evidentiary Gatekeeping," 57 JURIMETRICS J. 361, 387 (2017) (judgment in the case was entered 2016).

In another case, a product with the trade name Oscillococcinum was at issue, consisting of "Anas Barbariae Hepatis et Cordis extractum 200ck HPUS ("Anas Barbariae"), derived from crushed and

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meaningless. See generally, e.g., Randy Stein, "Evaluating the validity of Myers-Briggs Type Indicator theory: A teaching tool and window into intuitive psychology," *Social and Personality Psychology Compass,* e12434. 10.1111/spc3.12434. (2019). The judicial research and education agency of the California judiciary has used it. E.g., John W. Kennedy, Jr., "Personality Type And Judicial Decision Makng [sic]," 2 *Judicial Studies Institute Journal* 50 (2002), https://www.ijsj.ie/assets/uploads/documents/pdfs/2002-Edition-02/article/personality-type-and-judicial-decision-making.pdf; https://www.courts.ca.gov/documents/TCBAC-supplemental-materials-20140116.pdf at pp.56-57. I and my fellow new judges were given this test when we took the mandatory new judges' orientation in the early 2000s.

[46] http://www.jaapl.org/content/17/3/257.full.pdf

[47] https://nccih.nih.gov/health/homeopathy. See generally, Robert G. Knaier, "Homeopathy on Trial: Allen v. Hyland's, Inc. and A Failure of Evidentiary Gatekeeping," 57 *Jurimetrics J*. 361, 366 (2017).

[48] Robert G. Knaier, "Homeopathy on Trial: Allen v. Hyland's, Inc. and A Failure of Evidentiary Gatekeeping," 57 *Jurimetrics J*. 361, 380 (2017).

[49] https://www.theguardian.com/science/2007/nov/16/sciencenews.g2

[50] Id.

[51] https://www.britishhomeopathic.org/evidence/how-does-homeopathy-work/

incubated duck hearts and livers." *Lewert v. Boiron, Inc.,* 212 F. Supp. 3d 917, 921 (C.D. Cal. 2016), *aff'd,* 742 F. App'x 282 (9th Cir. 2018) (the court notes there are also other "inactive" ingredients, which is rich). The dilution to "200CK," 212 F.Supp.3d at 921, means there are no "molecules of the original active [sic] ingredient."[52] Plaintiffs, contending that Oscillococcinum was no better than a sugar pill (it actually was mostly sugar), had their experts to say so. But also "Defendants have presented their own expert testimony and studies to show that Oscillo is still effective to relieve flu-like symptoms despite its dilution." 212 F. Supp. 3d at 921. Remarkably, the court admitted defendants' expert testimony. 212 F. Supp. 3d at 933-934. The judge relied in part on a 2015 case, citing it this way: "*Allen v. Similasan Corp.*, 96 F.Supp.3d 1063, 1072–73 (S.D. Cal. 2015) (permitting expert testimony concerning general homeopathy theory to support expert's conclusion concerning effects of specific homeopathic drugs)." 212 F. Supp. 3d at 934. The cite is technically right, but it obscures the critical fact that *Allen* let in expert testimony, like the plaintiff's evidence in *Lewert*, to the effect that "homeopathy is *ineffective*," *Allen v. Similasan Corp.,* 96 F. Supp. 3d 1063, 1072 (S.D. Cal. 2015) (emphasis supplied). There is all the difference in the world between testifying that a sugar pill is ineffective and that it is effective. Perhaps a peculiar sense of even-handedness swayed the *Lewert* court.

Most significant is the Ninth's Circuit's opinion which by and large affirmed the defense verdict. That court treated the defense expert exactly as it would any other expert presented to provide scientific evidence, relying directly on *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 589–95 (1993):

> Here, all of the requirements of Rule 702 and *Daubert* were met: Dr. Calabrese is a board certified expert in toxicology who has published multiple books as well as hundreds of papers in peer-reviewed journals; several of Dr. Calabrese's works concern the principles of hormesis, about which he was called to testify; and Dr. Calabrese's testimony on the relationship between hormesis and homeopathy was derived from a literature review citing to several peer-reviewed sources in his field. The district court did not abuse its discretion by denying Allen's motion to exclude Dr. Calabrese's testimony.

Allen v. Hylands, Inc., 773 F. App'x 870, 873 (9th Cir. 2019). As another court noted, this was just an instance of an expert being allowed to opine based on his "literature review of several peer-reviewed sources in his field." *Cameron v. Lowes Home Centers Inc.,* No. CV-17-08082-PCT-JJT, 2019 WL 2665101, at *2 (D. Ariz. June 26, 2019).

This is the proverbial cautionary tale. This is what happens when courts look only to the qualifications of the witnesses *within* his area of expertise, and do not ask, from an outside vantage point, whether the area is scientific. This is a deference to the "proxy professional group" which *Sargon* was meant to block. See above, § 2.8.

2.10.4.3 Criteria for "science."

The topic is discussed at greater length below, but for now I suggest science is what actually works: it is *effective*.

> Not every branch of science can foretell the future — paleontology can't — but many can and with stunning accuracy. If you want to know when the next eclipse of the Sun will be, you might

[52] https://www.webmd.com/vitamins/ai/ingredientmono-1080/oscillococcinum

try magicians or mystics, but you'll do much better with scientists. They will tell you where on Earth to stand, when you have to be there, and whether it will be a partial eclipse, a total eclipse, or an annular eclipse. They can routinely predict a solar eclipse, to the minute, a millennium in advance. You can go to the witch doctor to lift the spell that causes your pernicious anaemia, or you can take vitamin Bl2. If you want to save your child from polio, you can pray or you can inoculate. If you're interested in the sex of your unborn child, you can consult plumb-bob danglers all you want (left-right, a boy; forward-back, a girl – or maybe it's the other way around), but they'll be right, on average, only one time in two. If you want real accuracy (here, 99 per cent accuracy), try amniocentesis and sonograms. Try science.

Carl Sagan, BROCA'S BRAIN: REFLECTIONS ON THE ROMANCE OF SCIENCE (1986).

Federal courts have done more to explore the notion, and a flavor of this work is found here:

As previously stated, *Daubert* made "reliability" the second of a three-pronged analysis for expert testimony admissibility. Following Daubert, judicial opinions focused on five so-called Daubert factors related to reliability of methodology:
(1) whether the theory or method can be/has been tested;
(2) the known or potential error rate of the method;
(3) whether it has been subject to peer review and publication;
(4) whether it is generally accepted in the scientific community; and
(5) the existence of standards controlling the method's operation.
Over time, courts have identified additional factors for consideration when weighing reliability of methodology, including the following:
(6) clarity and coherence of expert's explanation of theory, methods, and procedures (the expert's description of how the analysis was done, the logical flow of the reasoning);
(7) proper extrapolation (can the results of an animal study be extrapolated to humans?);
(8) breadth of facts, data, or studies (are the conclusions based on more than anecdotes? Are they based on multiple studies?);
(9) verifiability of the evidence or data;
(10) control or accounting for the confounding factors (were other possible causes of the injury or condition or outcome considered? Was an adequate control used?);
(11) use of facts or data reasonably relied on by experts in the field (standard practice in the field?);
(12) consistency of theory or findings with other studies, principles or experts in the field;
(13) statistical significance of findings;
(14) existence of real-world — i.e., apart from laboratory testing — data to support theory;
(15) court-appointed neutral expert's evaluation of evidence (Rule 706);
(16) purpose for which the research was conducted (for litigation?);
(17) reputation/qualifications of expert; and
(18) prior legal rulings regarding similar expert proffers.

Lawrence G. Cetrulo, 3 TOXIC TORTS LITIGATION GUIDE, "Inexplicit Daubert Factors" § 37:12 (2019).

Areas of expertise where advances are marked by these methods are likely to be truly scientific and so, reliable evidence. That is, whether an area is 'scientific' is another way of asking whether its research *methods*, as embodied in its studies and reports, are scientific. As Justice Breyer has suggested, the issue in most cases is not the worthiness of the general area of expertise, but the specific test or means or

technique employer by the expert in the case. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 156–57 (1999) ("the question before the trial court was specific, not general. The trial court had to decide whether this particular expert had sufficient specialized knowledge to assist the jurors 'in deciding the particular issues in the case'") (citation omitted). The collection of research papers and studies, and the means of experiments or other research set forth there, *comprise* the discipline. (For this reason, the two questions posed at the end of section 2.10.4.1. are the same.)[53]

2.10.4.4 Valid scientific reports.

Closely allied to the issue whether an area of expertise is really science is the issue of the validity of expert studies and reports themselves; indeed, as suggested just above it is the same question. This is the usual way the issue is framed, and was the issue, for example, in *Cooper* and *Wendell*. The criteria are similar to those just listed above. For example, many cases emphasize peer review and experimental data.[54] Federal courts are in accord:

> Scientific evidence is reliable if it is based on an assertion that is grounded in methods of science—the focus is on principles and methodology, not conclusions. Id. at 595–96, 113 S.Ct. 2786 [citing *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 113 S. Ct. 2786 (1993)]. The Supreme Court listed four non-exclusive factors for consideration in the reliability analysis: (1) whether the scientific theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether a particular technique has a known potential rate of error; and (4) whether the theory or technique is generally accepted in the relevant scientific community. Id. at 593–94, 113 S.Ct. 2786.
> In Daubert II we noted that a "very significant fact to be considered is whether the experts are proposing to testify about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying." 43 F.3d at 1317. If the evidence is not based upon independent research, the district court must determine whether there exists any "other objective, verifiable evidence that the testimony is based on scientifically valid principles." Id. at 1317–18 (internal quotation marks omitted). Peer review is the chief way of satisfying this requirement, though it may also be met by
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> > precisely [explaining] how [the experts] went about reaching their conclusions and point[ing] to some objective source—a learned treatise, the policy statement of a professional association, a published article in a reputable scientific journal or the like—to show that they have followed the scientific method, as it is practiced by (at least) a recognized minority of scientists in their field.
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> Id. at 1318–19, citing *United States v. Rincon*, 28 F.3d 921, 924 (9th Cir.1994).

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[53] I have developed the notion of dispensing with an investigation of "science" in favor of the examination of scientific methods. See my "Scientific Evidence: Grand Theories And Basic Methods," CORNELL LAW REVIEW (online) (forthcoming), preprint at https://works.bepress.com/curtis_karnow/53/

[54] See generally e.g., *Johnson & Johnson Talcum Powder Cases*, 37 Cal. App. 5th 292, 307 (2019); *Geffcken v. D'Andrea*, 137 Cal. App. 4th 1298, 1310 (2006); *Davis v. Honeywell Internat. Inc.*, 245 Cal. App. 4th 477, 490-491 (2016); *Cooper v. Takeda Pharm. Am., Inc.*, 239 Cal. App. 4th 555, 592 (2015); *People v. Reeves*, 91 Cal. App. 4th 14, 40 (2001); *People v. Smith*, 107 Cal. App. 4th 646, 658 (2003); *People ex rel. Brown v. Tri-Union Seafoods, LLC*, 171 Cal. App. 4th 1549, 1564 (2009).

Metabolife Int'l, Inc. v. Wornick, 264 F.3d 832, 841 (9th Cir. 2001) (emphasis supplied).

But this not entirely correct. Being "generally accepted in the relevant scientific community" is a useless tautology when the area is e.g. homeopathy or phrenology; and it will not do to just distinguish those areas as non-scientific, because that only begs the question. Whether a theory or technique has been "tested" too is not helpful because what counts as a meaningful test depends on the area of expertise.

And, perhaps most centrally, peer review studies are no guarantee of reliability, despite the seemingly privileged position that the criterion seems to have as evidence of a reliable scientific approach. For example, homeopathy enjoys at least 25 peer review journals[55] and has a professional association,[56] although there is no condition which responds convincingly better to homeopathic treatment than to placebo or other control interventions, and no homeopathic remedy has been demonstrated to yield clinical effects that are convincingly different from placebo.[57] Similarly, astrology, which is routinely covered in newspapers both in the US and around the world, has professional organizations,[58] the professionals charge fees for their services, claim to be able to infer from observations predictions about the future, and have formal licensing and certification procedures.[59] The 'discipline' has an extensive, published literature including peer reviewed journals.[60]

So it is emphatically not the case that peer review journals are a good indicia of scientific reliability. But the situation is more problematic still, because even mainstream peer review studies may be faulty. These faults can, with time and care, be identified. But the issue remains whether the judge or the jury is best placed to do so. The types of faults noted below are: fake papers, bad data, misleading use of p values, bias, and irreproducible results. A summary follows next. (A listing of further citations for these issues is provided in the Appendix 'Resources: Experts, Statistics, Science & Bad Science.')

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[55] http://www.homeobook.com/list-of-peer-reviewed-indexed-journals-in-homoeopathy/

[56] http://homeopathyusa.org/journal.html

[57] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1874503/; see also https://www.theguardian.com/science/2010/feb/26/bad-science-homeopathy-trials-drugs (placebo effect).

[58] http://www.opaastrology.org/; http://professionalastrologers.co.uk/

[59] https://www.astrologers.com/get-involved/afa-certified-astrologers/

[60] A Google search shows 4,330,000 book results. See also Jon S. Warner, "What's with All This Peer-Review Stuff Anyway?," Journal of Physical Security 22, 29 (2010) (204 journals devoted to astrology), including many peer reviewed journals, http://www.astrology-and-science.com/d-rese2.htm; http://astrologicalassociation.blogspot.com/2009/03/correlation-astrological-associations.html; Ken McRitchie, "Support for astrology from the Carlson double-blind experiment," http://www.theoryofastrology.com/carlson/carlson.htm ("This article has been peer reviewed by subject matter experts refereed by the publisher. ISAR International Astrologer Vol. 40(2), Aug. 2011. Pages 33-38. (Submitted Oct. 24, 2009).") A fun fact: more people (over 50%) think astrology is 'very' or 'sort of' scientific. http://www.motherjones.com/blue-marble/2014/02/public-opinion-astrology-dumb. This is *more* than the 48% who believe today's humans developed from earlier species of animals. http://www.npr.org/sections/thetwo-way/2014/02/14/277058739/1-in-4-americans-think-the-sun-goes-around-the-earth-survey-says).

2.10.4.4.1 Fake Papers.

These are wonderful creations, many of them literally (and instantly) computer-generated, but perhaps the easiest to spot once one's attention has been brought to bear.[61] Perhaps surprisingly, some of the most reputable journals and conferences have been victimized.

> The publishers Springer and IEEE are removing more than 120 papers from their subscription services after a French researcher discovered that the works were computer-generated nonsense. Over the past two years, computer scientist Cyril Labbé of Joseph Fourier University in Grenoble, France, has catalogued computer-generated papers that made it into more than 30 published conference proceedings between 2008 and 2013. Sixteen appeared in publications by Springer, which is headquartered in Heidelberg, Germany, and more than 100 were published by the Institute of Electrical and Electronic Engineers (IEEE), based in New York. Both publishers, which were privately informed by Labbé, say that they are now removing the papers.

Richard Van Noorden, "Publishers withdraw more than 120 gibberish papers: Conference proceedings removed from subscription databases after scientist reveals that they were computer-generated," *Nature Online* (24 February 2014).[62] Authors can be their own peer reviewer, which also is in effect fake peer reviewed papers:

> Fraudulent peer review can arise when editors rely on authors' recommended reviewers. These names are often genuine but have a false e-mail address that enables the authors to write a favourable review of their own paper. Springer Nature, also the publisher of *Nature*, this year retracted 107 papers from one of its journals on the basis of fake peer review (see T. Stigbrand, *Tumor Biol.* doi.org/b7gg; 2017). Two years ago, it retracted 64 articles in 10 of its journals on similar grounds (see *Nature* doi.org/b7gh; 2015).[63]

2.10.4.4.2 Bad Data

Data usually have to be random in order to generate meaningful results. Testing a drug to be used on a whole population only with elderly subjects or babies is likely to give misleading results on the drug's efficacy or dangers. Proper statistical manipulation of data relies on random samples because the point is to be able to extrapolate from a small group (the sample) to the universe from which it is drawn, and only a random sample is likely (to some specified extent) to reflect the qualities of the universe. (This sort of problem could be described as a type of bias, because the results of a non-random sample are said to be 'biased'). *Duran v. U.S. Bank Nat'l Assn.,* 59 Cal. 4th 1, 22 (2014) (problem when sample is not random); *U.S. ex rel. Jones v. Brigham & Women's Hosp*., 678 F.3d 72, 88 (1st Cir. 2012); *Rios v. Enter. Ass'n Steamfitters Local Union 638 of U.A*., 860 F.2d 1168, 1178 (2d Cir. 1988). Readers will also be familiar with the notion of "cherry picked" data which too is not random, but selected instead to

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[61] See this guide's appendix *Resources: Experts, Statistics, Science & Bad Science* under "fake science papers."
[62] https://www.nature.com/news/publishers-withdraw-more-than-120-gibberish-papers-1.14763
[63] https://www.nature.com/articles/546033a. See also e.g., https://www.theguardian.com/science/2017/jun/05/dozens-of-recent-clinical-trials-contain-wrong-or-falsified-data-claims-study ("Dozens of recent clinical trials contain suspicious statistical patterns that could indicate incorrect or falsified data, according to a review of thousands of papers published in leading medical journals…..90 published trials had underlying statistical patterns that were unlikely to appear by chance in a credible dataset, the review concluded.")

generate the sought-for result. E.g., *Baldwin v. Berryhill*, 746 F. App'x 580, 583 (7th Cir. 2018); *E.E.O.C. v. Freeman*, 778 F.3d 463, 469 (4th Cir. 2015).

But discerning cherry picking and other data manipulations can be difficult.[64] Sometimes data is just fake. For example, a survey of professional academic economists suggests many will cheat. The paper's abstract reads: "This study reports the results of a survey of professional, mostly academic economists about their research norms and scientific misbehavior. Behavior such as data fabrication or plagiarism are (almost) unanimously rejected and admitted by less than 4% of participants. Research practices that are often considered 'questionable,' e.g., strategic behavior while analyzing results or in the publication process, are rejected by at least 60%. Despite their low justifiability, these behaviors are widespread. *Ninety-four percent report having engaged in at least one unaccepted research practice.*" About 94% admit to committing "at least one unaccepted research practice." The paper notes, "these behaviors are widespread."[65]

2.10.4.4.3 P values.

Most studies purporting to be scientifically valid will report a so-called "p value" which, roughly speaking, is the measure of the odds that the results are a function of random chance (because if they are the result of random chance then the results are meaningless).[66] A low p value is good, and a high one is bad. By convention a p value of less of 0.05 (written out "$p \leq 0.05$") which means (again, very roughly) that only one in 20 times would the study report random chance, allows the author to claim a statistically valid (or "significant") study.

There is a now a sea of articles on how p values can be, and often are, manipulated so as to suggest that the findings of a study are statistically significant. Some suspect results are garbed in language that seems to promise statistical significance but is in fact a bright red flag that none exists, e.g.,

- approached the borderline of significance (p=0.07)
- at the margin of statistical significance (p<0.07)
- close to being statistically significant (p=0.055)
- fell just short of statistical significance (p=0.12)
- just very slightly missed the significance level (p=0.086)

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[64] Geoff Cumming, "The New Statistics: Why and How," 25 *Psychological Science* 7, 10-11 (2014), https://journals.sagepub.com/doi/pdf/10.1177/0956797613504966. See Matt Ridley, "The Real Risks Of Cherry Picking Scientific Data," (7 January 2014) (how cherry picked data likely caused the waste of "nearly half a billion pounds on a flu drug that might not be much better than paracetamol [acetaminophen, one brand of which is Tylenol]." http://www.rationaloptimist.com/blog/the-real-risks-of-cherry-picking-scientific-data/

[65] "How often do economists commit misconduct?" http://retractionwatch.com/2014/06/30/how-often-do-economists-commit-misconduct/

[66] The technical definition is actually what one might term the obverse of this, a measure of the likelihood that the opposite of the result one is testing for is true: "The P value, or calculated probability, is the probability of finding the observed, or more extreme, results when the null hypothesis (H0) of a study question is true…." https://www.statsdirect.com/help/basics/p_values.htm. So if one were testing to see if a drug cures headaches, the *null* hypotheses would be that the drug does *not* cure headaches. The point is that p values don't tell you if a hypothesis is true (e.g., the drug cures headaches) because it only measures the likelihood that its opposite (the drug doesn't cure headaches) is true. So, if $p \leq 0.05$ with my drug testing, then I would reject the null hypothesis that the drug doesn't cure headaches. In the text I will however for simplicity's sake stick with the popular view of the term 'p value,' because the point is that, however defined, it is liable to manipulation.

- near-marginal significance (p=0.18)
- only slightly non-significant (p=0.0738)
- provisionally significant (p=0.073)[67]

The frequency with which p values are manipulated—consciously or unconsciously—is so high it has its own term- "p hacking." It is "widespread throughout science."[68] The problem sometimes can be detected with metastudies, that is, studies which comb though other studies. This, of course, requires a good sample of the underlying studies, and as we see below, many studies are suppressed, or those which might confirm or dispute an initial study are never undertaken.

P hacking is fun. The web site FiveThirtyEight allows you to do it yourself.[69]

The second issue with p values is that it is the value of statistical significance. It does not measure the *strength* of the evidence for the effect measured. Suppose we test a drug for its ability to cure headaches. We'll have a control group that gets a placebo drug, and another than gets the drug under examination. Say we have a result where $p \leq 0.05$. This tells us nothing about how *effective* the drug is, i.e., the difference to the human subject between dosing with the drug and not. It might be a very, very small effect. To understand the strength of the difference between two groups (control vs. experimental) one calculates the *effect size*. That is a very different number and derived differently from a p value.[70] Effect size is rarely reported.

2.10.4.4.4 Bias.

Some of the data manipulations alluded to above many be conscious or unconscious. Both may be in operation when, as is often the case, drug trials are funded by the maker of the drug. In those cases there is an incentive to bias the data, cherry pick the data, and play with p values. And it may be that results will be released only if positive and otherwise they will be suppressed. This is important for reasons which are likely obvious, but which are set out below in connection with the discussions of metastudies.

There is also a general bias in favor of breakout results. Most scientists are interested in publication and professional advancement; no one wants to play second fiddle. Publications are biased in favor of breakout results, and are less likely to publish reruns of prior studies—which means scientists are unlikely to do follow up studies. This includes follow-up studies which might confirm and also those which negate a prior study: Publications tend not publish those either, so researchers aren't tempted to try them.[71] In short, "Statistically significant, 'positive' results that indicate that an intervention works

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[67] The Initab Blog, https://blog.minitab.com/blog/understanding-statistics/what-can-you-say-when-your-p-value-is-greater-than-005 (December 3, 2015), reporting on https://mchankins.wordpress.com/2013/04/21/still-not-significant-2/

[68] M. Head, et al., "The Extent and Consequences of P-Hacking in Science (March 13, 2015). https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002106. See also e.g., https://www.wired.com/story/were-all-p-hacking-now/

[69] https://fivethirtyeight.com/features/science-isnt-broken/#part1. This includes an excellent plain English description of the problem, as well as an expression of hope that the self-correcting forces of science will generate correct results.

[70] See generally, https://www.simplypsychology.org/effect-size.html

[71] http://www.alltrials.net/; http://boingboing.net/2014/05/15/half-of-all-clinical-trials-ne.html (half of all clinical trials have never been published)

are more likely to be published, more likely to be published rapidly, more likely to be published in English, more likely to be published more than once, more likely to be published in high impact journals and, related to the last point, more likely to be cited by others."[72] So, confronted with a study showing an association between e.g. a chemical and disease, or a drug and a purported cure, one might well wonder if there are undisclosed conflicting studies. This matters a great deal, as I note in my discussion of jelly beans below.

2.10.4.4.5 Irreproducible results.

The bias in favor of breakout results is the more painful when one realizes that even when a study is done again, the results often can't be reproduced. One researcher for example selected 53 "landmark" publications, that is, "papers in top journals, from reputable labs." But as he reported to the journal *Nature*, his team could only reproduce six of these.[73] Other attempts have had similar results.[74] The problem has spawned an alarmed 2019 report from the National Academies of Sciences, Engineering, and Medicine.[75]

And in what might be thought of as the converse side of the problem, some researchers report their findings multiple times in order to make it seem as if there is more support for the findings, and because multiple reports and papers look better on the resume.[76]

2.10.4.4.6 Metastudies.

Because (i) a statistically significant study has a 5% chance being simply the result of random chance (to use the popular notion of p value), (ii) studies that appear similar may involve different unknown variables, (iii) some studies have small sample size, and have a consequent unreliability, and (iv) biases may infect many studies, virtually all scientists agree that metastudies are a crucial step in evaluating results.[77] These are studies of studies, and one can find metastudies (or meta-analyses) in many areas. Courts understand their import. See e .g., *In re Nexium Esomeprazole*, 662 F. App'x 528, 530 (9th Cir. 2016) (meta-analyses casting doubt on opinion); *Davis v. Honeywell Internat. Inc*., 245 Cal. App. 4th 477, 484 (2016); *In re Neurontin Mktg. & Sales Practices Litig.,* 712 F.3d 21, 51 (1st Cir. 2013). The *Cooper* court pointedly noted that a meta-analyses strongly supported the expert opinion. *Cooper v. Takeda Pharm. Am., Inc.*, 239 Cal. App. 4th 555, 564 (2015). But metanalyses of course require original analyses and studies on which they rely. And without enough, metastudies are not feasible. *Video Software Dealers Ass'n v. Schwarzenegger,* 556 F.3d 950, 963 (9th Cir. 2009), *aff'd sub nom. Brown v. Entm't*

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[72] https://methods.cochrane.org/bias/reporting-biases

[73] https://www.reuters.com/article/us-science-cancer/in-cancer-science-many-discoveries-dont-hold-up-idUSBRE82R12P20120328

[74] "In 2011, scientists at Bayer Healthcare in Germany recounted their dismal experience in trying to validate published research on new drug targets: in more than 75 percent of the 67 studies they attempted, Bayer's labs could not replicate the published findings." https://www.the-scientist.com/news-opinion/do-that-again-40604. In another example, "According to work presented today in Science, fewer than half of 100 studies published in 2008 in three top psychology journals could be replicated successfully." https://www.smithsonianmag.com/science-nature/scientists-replicated-100-psychology-studies-and-fewer-half-got-same-results-180956426/. See C. Cali, "New rule on clinical trial reporting doesn't go far enough," (Jan. 17, 2017), https://www.statnews.com/2017/01/17/clinical-trial-reporting-new-rule/

[75] http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=25303

[76] http://en.wikipedia.org/wiki/Duplicate_publication

[77] See generally, https://www.meta-analysis.com/pages/why_do.php

Merchants Ass'n, 564 U.S. 786 (2011). (Of course, metastudies, as with any other study, may or may not be done in a valid way. *Miller v. Pfizer, Inc.,* 356 F.3d 1326, 1331 (10th Cir. 2004); *In re Paoli R.R. Yard PCB Litig*., 916 F.2d 829, 857 (3d Cir. 1990).) An important group advocating for and supporting metanalyses is Cochrane, which makes many of these publicly available.[78]

Metastudies can be useful in in detecting some types of bias and p hacking, but they depend on a fairly representative body of work, and are more or less useful depending on the extent to which e.g., reports are dishonestly duplicated (i.e. there is actually only 1 study), or studies are suppressed or simply difficult to locate.[79] That is, they can be strong evidence but ultimately depend on the integrity of the underlying studies, and those, as we have seen are subject to many infirmities.

2.10.4.4.7 The jelly bean problem and statistical literacy.

The jelly bean problem is a good way to understand the interrelated issues posed by (i) the nature of p values, (ii) the fact that many studies are never done or they are unreported, (iii) cherry picking, and (iv) metastudies.

Imagine our hypotheses is that some flavor of jean beans cause acne. We do 20 different studies, one with each color—red, green, pink jelly beans, and so on. Given the definition of p value, at least one of the 20 studies will provide a positive result by sheer chance, showing a statistically significant correlation between acne and a type of jelly bean - say, the blue ones. We now publish a study that states the statistically significant correlation of blue jelly beans and acne, honestly stating the value of $p \leq 0.05$.

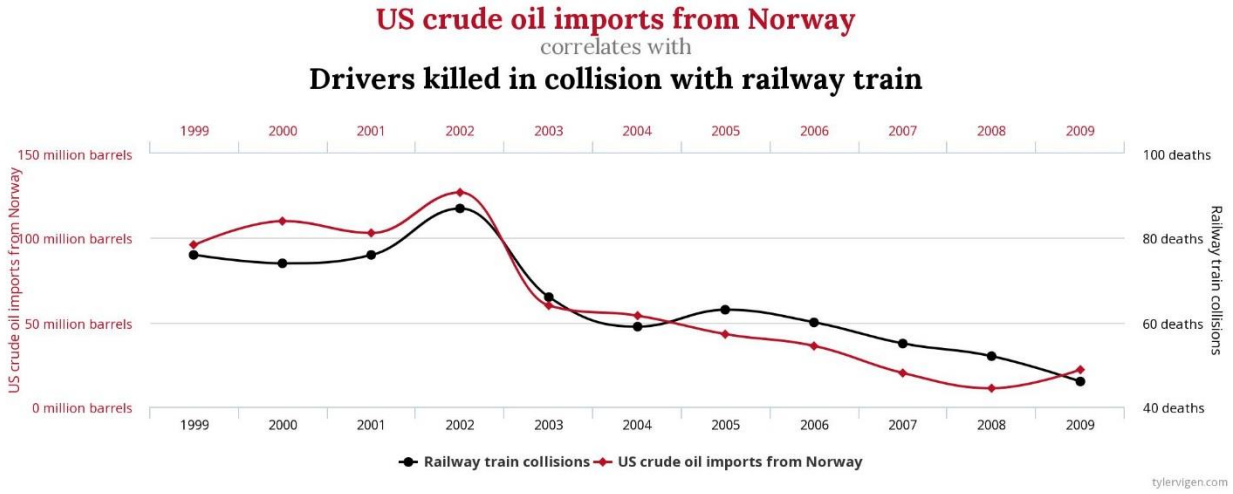
What went wrong? We cherry-picked the data, and the result is gibberish. But if all the rest of the studies-- those with red, pink and orange beans-- go unreported, the result might look valid.

By the way, notice in the paragraphs above that my hypothetical shifted from showing *causation* to the *correlation* of bean color and acne. This is a dangerous slip, made by many readers of studies. Studies usually don't show causation, they show correlation and correlation may at best only allow an inference of causation. The rooster crowing at daylight correlates with the sun coming up, but doesn't cause it. If one cherry-picks the data, correlation among widely disparate groups of data can be shown, for example:[80]

[78] https://www.cochrane.org/about-us

[79] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3049418/. "All sorts of datasets from studies can be meta-analyzed - and in different ways. A key question to consider is whether or not it was part of a systematic review that looked for all the relevant studies on the question." H. Bastian, "5 key Things To Know About Meta-studies," *Scientific American* (January 20, 2014), https://blogs.scientificamerican.com/absolutely-maybe/5-key-things-to-know-about-meta-analysis/

[80] https://www.tylervigen.com/spurious-correlations. The reader may use the site to make correlation charts of wonderfully disparate types of data. It is interesting that in *Hardeman*, the Ninth Circuit affirmed a trial court's reliance on animal and cell studies to find general causation, but only because epidemiological studies showed "an association between" the chemical in question and the disease in humans. *Hardeman v. Monsanto* 997 F.3d 941, 963 (9th Cir. 2021). This could be the use of correlation to show causation. There was however no suggestion of cherry-picking in the opinion.



Of course the correlation shown to a court won't be oil imports *vs*. drivers killed in train collisions; the result will seem far more plausible, but it may not be any more valid. "[S]tatistically correlated relationships may be accidental, lacking practical significance." *Craik v. Minnesota State Univ. Bd*., 731 F.2d 465, 509 (8th Cir. 1984). The point is that one may be easily fooled by spurious statistics, and so by reports which look fine to a layperson such as a judge or a juror, but which are actually nonsense. Judge Posner has authored an opinion which is particularly painful to read, as he noted that "neither party's lawyers, judging from the trial transcript and the transcript of the Rule 702 hearing and the briefs and oral argument in this court, understand regression analysis; or if they do understand it they are unable to communicate their understanding in plain English," and remarking the trial judge knew little more. *ATA Airlines, Inc. v. Fed. Exp. Corp.,* 665 F.3d 882, 889 (7th Cir. 2011).

There is no room here to attempt a useful background in statistics, but there are resources: Those noted by Judge Posner in *ATA Airlines*, and others in the Appendix to this guide under the rubric of "Resources: Experts, Statistics, Science & Bad Science."

There's another way to think about this problem of cherry picking, and it involves an infamous dead salmon. The salmon was placed in a brain imaging machine (*f*MRI). Researchers showed it pictures of humans in various contexts, and asked the salmon what it thought the humans were feeling. Although the salmon declined to respond verbally, bits of its neurons lit up at various times. The researchers did the "experiment" repeatedly regarding various locations in the salmon brain until—like the blue jelly bean—they had a "statically significant" result.[81] The over 8000 significance tests had—by chance alone—led to a "significant" result.[82] This is termed the "multiple comparisons,"[83] or "multiple testing" problem, and there is a solution, which is to tell the reader how many comparisons were made. As Spiegelhalter notes, the Bonferroni correction does just that, incorporating the number of tests done into its correction, such as e.g. creating a threshold of 0.05/*n* where *n* = number of tests. So if we had 8000 tests, the p value would not be 0.05, but rather 0.05/8000 = 0.00000625.[84]

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[81] C. Bennett et. al. "Neural Correlates of Interspecies Perspective Taking in the Post-Mortem Atlantic Salmon: An Argument for Multiple Comparisons Correction." Poster presentation at the 2009 Human Brain Mapping Conference. See also http://prefrontal.org/files/posters/Bennett-Salmon-2009.pdf.

[82] David Spiegelhalter, THE ART OF STATISTICS: HOW TO LEARN FROM DATA 279 (2021).

[83] https://blogs.scientificamerican.com/scicurious-brain/ignobel-prize-in-neuroscience-the-dead-salmon-study/. See also, e.g., https://uh.edu/engines/epi2883.htm

[84] David Spiegelhalter, THE ART OF STATISTICS: HOW TO LEARN FROM DATA 280 (2021).

2.10.5 Conclusions on the *Cooper* problem.

It is worth repeating here that most of the studies and reports discussed just above are peer reviewed, and to the lay person they appear as valid scientific studies. Courts should not decide that an opinion is admissible because it relies on peer reviewed studies, or that a discipline qualifies as 'scientific' because it investigates and establishes its principles through such studies. The concern is not simply that if it were so, astrology and homeopathy would qualify (and they would); it is more that results that seem far more mainstream and in some sense *patently scientific* will also slip though, when the truth is that the support for some of those results is as weak as for homeopathy. These is an endemic problem, not confined to what some might think as marginal areas: the problem probably extends to what passes for mainstream economics, for example.[85]

The central role of the judge in a *Sargon* hearing is to exclude evidence which is speculative including opinion *based* on speculation. *Sargon*, 55 Cal. 4th at 770. This is either part or, or a different way of phrasing, the criteria of *reliability*.[86] So: judges handle reliability as an evidentiary issue. Juries handle the credibility of opinions, as *Cooper* notes in one of its quotations from *Sargon*: "The trial court's preliminary determination whether the expert opinion is founded on sound logic is not a decision on its persuasiveness." *Cooper*, 239 Cal. App. 4th at 590. Judges don't get involved in disagreements between experts when each has a reliable scientific basis: "The court does not resolve scientific controversies." *Sargon*, 55 Cal. 4th at 772. The judge decides if an opinion is reliable. The jury decides which opinions are "more reliable". *Lewert v. Boiron, Inc.,* 212 F. Supp. 3d 917, 934 (C.D. Cal. 2016), *aff'd,* 742 F. App'x 282 (9th Cir. 2018), quoting *Dorn v. Burlington N. Santa Fe R.R. Co.*, 397 F.3d 1183, 1196 (9th Cir. 2005).

But the line between reliability and *more* reliability—or credibility—is thin, and when it comes to scientific reports and studies, it may be too thin to discern. At what point should a judge reject an opinion based on studies which for example exhibit some p hacking, non-random data, or a meta-analysis which fails to explain how it got its arms around all the studies done (or fails to explain why it didn't and what effect that might have)? What does a judge do when faced with a single study, and she wonders if the results are reproducible—and whether anyone has even tried? Compare e.g., *Lockheed Litig. Cases*, 115 Cal. App. 4th 558, 564 (2004) (rejecting a single study basis, albeit for a series of reasons); *Am. Fed'n of Labor & Cong. of Indus. Organizations v. Occupational Safety & Health Admin., U.S. Dep't of Labor*, 965 F.2d 962, 976 (11th Cir. 1992) (denigrating result based on single study); *Harte v. Bd. of Commissioners of Cty. of Johnson, Kansas*, 864 F.3d 1154, 1200 n.7 (10th Cir. 2017) (same).

Distinguishing between reliability and credibility is not as pressing when the judge is also the fact finder, as she is in motions for class certification, injunctions, and at bench trials: for then the judge may reject a poor opinion either or both because it is bad science and inadmissible and because it is weak science and so not worthy to be believed. But in most other situations including the usual one, which is admissibility at a jury trial, this legerdemain is unavailable.

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[85] E.g., Thomas Piketty, CAPITAL IN THE TWENTY-FIRST CENTURY 18, 169-70, 372, 418-19, 452, etc. (2017).

[86] *Cooper*, 239 Cal. App. 4th at 587 (implying "foundation for ... causation [should be] reliable") and *id*. at 590 (discussing reliability); *Asahi Kasei Pharma Corp. v. Actelion Ltd*., 222 Cal. App. 4th 945, 969 (2013) (citing *Sargon*); *Apple Inc. v. Superior Court*, 19 Cal. App. 5th 1101, 1118 (2018) (same); *People v. ConAgra Grocery Prod. Co*., 17 Cal. App. 5th 51, 142 (2017) (reliability, citing *Sanchez*, 63 Cal 4th at 682); *Sargon*, 55 Cal. 4th at 772 (discussing reliability). See also *Kumho Tire*, 526 U.S. at 152–53 (reliability is the touchstone).

Cooper and *Wendell* seemed to solve the problem by relying on the outstanding credentials of the sponsoring expert,[87] suggesting that the expert may be relied on to tell the judge not to worry about the foundational studies and reports. This sort of reliance on the expert is tempting in most cases, because we all think we know highly qualified experts when we see them—they have a good university degree, advanced studies, much experience, many papers, awards, and so on. Judges rely on this sort of thing all the time. But I have suggested above in the section titled 'Do the Rules Help?' that reliance on the expert himself can be tricky, and in some cases it is circular reasoning.

Future appellate authorities may help us understand the line between weakness in the underlying studies which are to be resolved in front of the jury, as *Cooper* teaches, and weaknesses which implicate admissibility questions for the judge.

> Comment. Perhaps trial judges should have an expanded role here, using the fundamental criteria of reliability to block admissibility of opinions founded on questionable studies.[88] The current line—as thin as it might be—is derived from the usual doctrine allocating to the jury the job of weighing evidence. But as some pretrial hearings on expert admissibility show, including the eight day session in *Sargon*, this can be laborious. The process centers on studies which are difficult to understand, and have unfamiliar wording and formula. In one Proposition 65 case I handled (where all issues were committed to the court), the case depended entirely on expert testimony, all of it apparently admissible such that the disputes centered on the relative weight to be given to the competing studies and opinions. About 50 studies were involved, and counsel spent days walking me through these. I probably spent far more time on the studies as fact finder, seeking to be sensitive to their relative weights and import, than I would have had I taken *Cooper's* advice in a pretrial Evid. C. § 402 hearing to determine their admissibility. That is, a fact finder's evaluation of purportedly scientific studies can be more complex than that of a judge evaluating basic admissibility. Done in front of a jury, the process is difficult if not impossible. It is difficult because judges can ask questions when they are the fact finder; jurors can too, but these are more formal and do not engender a useful back and forth to flesh out some notion. Judges are used to spending a lot of time with written materials; jurors usually just listen and look. The process is well-nigh impossible because, at least under current law, the studies are not even provided to the jury during direct examination—the very examination when they are the most pertinent. And under current law it may be that only a few studies, and only parts of them, will be—to coin a phrase—cherry picked during cross examination to make the expert look bad. When the jury isn't given all the studies and reports, it's difficult to know how to implement *Cooper*'s requirement that we leave their weight to cross examination:
>
> > The flaws in the study methodologies were explored in detail through cross-examination and with the defense expert witnesses, and constituted evidence that went to the weight and not the admissibility of Dr. Smith's opinion testimony based on those studies. Those were matters for the jury to decide.

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[87] *Cooper*, 239 Cal. App. 4th at 591 (2015) ("Dr. Smith is one of the foremost experts in the world on bladder cancer"); *Wendell v. GlaxoSmithKline LLC,* 858 F.3d 1227, 1233–34 (9th Cir. 2017) (outstanding experience of experts).

[88] This may be similar to the role federal judges have. See e.g., Craig A. Barr, "A Practical Guide to Proving and Disproving Causation in Radiation Exposure cases: Hanford Nuclear Site and Radioactive Iodine," 31 GONZ.L.REV. 1, 15-16 (1996).

Cooper v. Takeda Pharm. Am., Inc., 239 Cal. App. 4th 555, 593 (2015).

> There's another benefit to having judges further involved in weighing expert scientific opinion, which is that the nature of appellate review might change as well. Under the current regime, the court of appeal can affirm different verdicts by juries which accept *and* reject the same series of opinions and their underlying studies. This can be maddening for lawyers and parties, and contributes to the unappetizing sense that one is "rolling the dice" with a jury trial. Judges' determinations made as a matter of law are subject to de novo review, which means the appellate courts can over time establish some consistency.

Although it does not add much to the analyses above, some historical backdrop to the *Cooper* problem is presented next, which may be of general interest.

2.10.6 **Historical Note**

Many jurisdictions, including California, find themselves in this interesting situation of leaving it to the jury to decide scientific controversies as they pick between experts (or perhaps reject them all). This may be a result of events reaching back to at least the eighteenth century: the development of our adversarial system, the industrial revolution and modern science,[89] and the evolving distinction between expert and percipient witnesses.

Expertise originally came from jurors, picked particularly for their knowledge of the case (knowledge which likely would disqualify them today).[90] By that time (the fourteenth century) courts also consulted with experts,[91] such as surgeons to determine if a wound was fresh.[92] There was presumably one answer: The food was or was not rotten, the wound was, or was not, fresh. Presumably too, there was an answer to the question in the celebrated case of *Folkes v. Chadd*, 3 Doug. 157, 99 Eng. Rep. 589 (1782) as to what was causing the decay of a Norfolk harbor.[93] The distinction between perceived facts and expert opinion –and the admission of the latter -- is commonly traced to the *Folkes* case. I suggest that the admission of what was in retrospect seen as the distinct type of evidence we dub 'expert opinion' was enabled by equating (1) the expert's general knowledge in his field of expertise with (2) personal knowledge of facts.

At issue in *Folkes* was the testimony of an engineer as to why a harbor had filled up:

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[89] Tai Golan, *Revisiting the History of Scientific Expert Testimony*, 73 BROOK. L. REV. 879 (2008) ("Golan"), available at https://brooklynworks.brooklaw.edu/blr/vol73/iss3/3.

[90] E.g. *id*. at 882; see also Jennifer L. Mnookin, "Idealizing Science and Demonizing Experts: An Intellectual History of Expert Evidence," 52 VILL. L. REV. 763, 767–768 (2007) (note omitted) ("Mnookin") ("Juries made up of merchants or members of a particular guild or trade might make determinations relating to matters of trade. In a case dating back to 1351, in which a defendant was charged with selling rotten food, the jury consisted of cooks and fishmongers, well-positioned by virtue of their specialized experience to evaluate the merits of the claim"); Stephan Landsman, "A Brief Survey of the Development of the Adversary System," 44 OHIO ST.L.J. 713, 772 (1983).

[91] L. Hand, "Historical And Practical Considerations Regarding Expert testimony," 15 Harv.L.Rev. 40 (1901).

[92] Mnookin at 768; Maury R. Olicker, "The Admissibility of Expert Witness Testimony: Time to Take the Final Leap?" 42 U. MIAMI L. REV. 831, 835 (1988).

[93] Golan at 888 ff. The witnesses, although called by the parties, appeared to be treated as court experts. *Id*. at 899-90, 903.

> It is objected that Mr. Smeaton is going to speak, not as to facts, but as to opinion. That opinion, however, is deduced from facts which are not disputed—the situation of banks, the course of tides and of winds, and the shifting of sands. . . . I cannot believe that where the [question] is, whether a defect arises from a natural or an [artificial] cause, the opinions of men of science are not to be received. . . . The cause of the decay of the harbor is also a matter of science . . .. Of this, such men as Mr. Smeaton alone can judge. Therefore we are of opinion that his judgment, formed on facts, was very proper evidence."[94]

But still, expert 'opinion' was the recitation of facts, albeit facts only an expert might deduce, or facts as might be known by skilled personnel (how to build a ship, the meaning of a Latin phrase, and so on[95]). This was not opinion in the sense of an idiosyncratic view, or as we might say that we're all entitled to our 'opinion' on art, or food, etc. Rather, this was opinion as blunt fact (how to translate "*de gustibus non disputandum est*," or how to build a ship) or, at its most remove, as inference of a fact (whether a wound was recent) but nevertheless known as a fact to the discerning and experienced eye. Up to the end of the eighteenth century, there was thus no conceptual distinction between percipient and expert witnesses.[96]

"Until the ninetieth century, all available scientific knowledge of any consequence could be encompassed by a single first class mind." W.V.O. Quine "Has Philosophy lost contact with the people?" in his THEORIES AND THINGS at 191 (1981). But then the industrial revolution kicked into high gear, and with it Increasing specialization and the division of labor called out by Adam Smith in his *The Wealth of Nations* (1776),a study which a century later weas the predicate of Émile Durkheim's *The Division of Labour in Society* (1893), which found counterparts in the developing sciences and multiplying areas of expertise.

The increasingly pace of scientific discoveries generated, with concomitantly increasing frequency, new 'truths,' including *contrasting* views of these scientific truths. As importantly, these 'truths' were of a new type: the results of experiments, as summarized and analyzed in studies and reports. John Snow famously analyzed the 19th-century cholera epidemics in London. His review of the data showed the source as the Broad Street pump. These sorts of scientific "facts" then were at an increasing remove from common knowledge, their reliability depending on the reliability of the research and modes of analysis. And the experts of experience—doctors and ship builders—too increasingly were taught theory, and relied not just on personal experience, or the personal transmissions of experience from a senior expert, but relied also on the equivalent of studies, reports—in short, on the literature of their trade. "Expert" testimony had long been admissible by then, and the law seemed to make no distinction, and perhaps could not be expected to make any, between these sorts of expert testimony: experts testified as to 'facts' they knew in both their capacity as experienced and skilled in an area, as well as deduced from the research and studies of others.

Turning directly to the evolution of the adversarial system, formerly questions were from the judge, not lawyers.[97] This is reminiscent of the so-called inquisitorial system, current in many European

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[94] Maury R. Olicker, "The Admissibility of Expert Witness Testimony: Time to Take the Final Leap?" 42 U. MIAMI L. REV. 831, 836 (1988) (note omitted).
[95] Golan at 882.
[96] Tai Golan, "History of Expert Testimony in the English Courtroom," 12 SCIENCE IN CONTEXT 7, 8-9 (1999).
[97] Golan at 883.

countries.[98] So the witnesses (percipient, as well as what we have come to call 'expert,' witnesses) were questioned by the judge who decided whether or not to accept their testimony; there was little serious cross examination.[99] Under this system of course, there was no formal distinction between admissibility of evidence (today decided by the judge) and its weight or overall reliability (decided by the jury). The opinions were offered, and they were just evaluated by the trier of fact—historically, the judge. In this way, too, expert opinion was evaluated the same way as percipient fact. Being questioned just by the judge "conferred on these experts a large degree of impartiality."[100]

But by 1820 the adversarial system was in full play.[101] Lawyers were locating evidence, preparing witnesses and conducting examinations, presenting adversarial arguments before the judge and jury: "during the eighteenth century, as the court assumed a neutral position, free reign was increasingly given in the courtroom to partisan views."[102] As judges backed away from their inquisitorial role, they shifted into their role as adjudicators of evidence—leading to development of evidence as a formal body of law. And as the adversarial system came into force, it took full advantage of the fact that experts had opinions not only as educated percipient witnesses, but as purveyors of emerging theories and varied interpretation. So it was that experts, now routinely called by both sides in the fully developed adversarial context, would contradict each other, much to the chagrin of the judges.[103] By the beginning of the twentieth century, judges such as Learned Hand were not happy with these contradictions, finding them incompatible with the notion of scientific truth to which all properly qualified experts would of necessity agree.

> But how can the jury judge between two statements each founded upon an experience confessedly foreign in kind to their own ? It is just because they are incompetent for such a task that the expert is necessary at all.
> …
> they will do no better with the so-called testimony of experts than without, except where it is unanimous. If the jury must decide between such they are as badly off as if they had none to help.
>
> L. Hand, "Historical And Practical Considerations Regarding Expert testimony," 15 HARV.L.REV. 40, 54, 65 (1901).

Full blown skepticism of experts ensued.[104] That lasts, of course, to this day.[105]

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[98] Gerald Walpin, "America's Adversarial and Jury Systems: More Likely to Do Justice," 26 HARV. J.L. & PUB. POL'Y 175, 176 (2003) ("inquisitorial system, in which the judge plays the pivotal role in adducing the facts and deciding every case").

[99] Stephan Landsman, "One Hundred Years of Rectitude: Medical Witnesses at the Old Bailey, 1717-1817," 16 LAW & HIST. REV. 445, 447 (1998).

[100] Golan at 885.

[101] It had developed slowly for the preceding few hundred years. Landsman supra n.95 at 729. See generally Randolph N. Jonakait, "The Rise of the American Adversary System: America Before England," 14 WIDENER L. REV. 323, 324 (2009) (different pace of development in England and United States).

[102] Tai Golan, "History of Expert Testimony in the English Courtroom," 12 SCIENCE IN CONTEXT 7, 10 (1999).

[103] Golan at 907.

[104] "Experimental evidence …. was considered to be among the surest species of evidence, and the judges found it exceedingly difficult to accept the fact that similar experimental procedures were constantly producing antithetical results when conducted by opposed experts. Such conflicting experimental results, they believed, represented the partisanship of the men of science who produced them, and since these men were highly paid for their services,

The previous arrangement by which witnesses' testimony (percipient or expert) was considered by the trier of fact continued: but now it was the jury, not the judge, who heard it.

So we have, in brief, these developments: The industrial revolution ramified science, producing more types of experts; and hand-in-hand with the adversarial system it made much room for varied opinion. We had the concurrent emerging distinction between percipient and expert witnesses; but, carrying over the jury's old role of evaluating fact witnesses, the jury decided whether or not to believe expert opinion. We might say that the 'reliability' of an expert's opinion was in that way equated with the ordinary 'reliability' of a fact witnesses. So it is that now juries and not judges have the central role in determining experts' reliability; for good or ill.

2.11 Causation: multiple linear regression, Bradford Hill, and relative risk

The scientific studies and expert opinions discussed above concern causation: whether exposure to a chemical, or other factors, leads to injury. The terms 'general' and 'specific' causation are used to distinguish the tendency of the cause generally to cause the injury, from the fact whether the cause, in the case of plaintiff, actually did so.[106] So we might have an issue of general causation whether tobacco smoking causes cancer, and the specific causation issue of whether it did in the case of a given person.

Our intuitions about causation are entirely unreliable. Long before the landmark work from David Hume (1711–1776)[107] people have speculated the extent to which our perceptions of causality are simply the product of custom and imagination, views based on our personal experiences of the world, carried forward into predicting the future through unreliable induction. We tend to think of causation as some

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their conduct was seen as the prostitution of their science, of selling its credibility to the highest bidder. Thus, as the [nineteenth] century advanced and the legal use of scientific expertise grew exponentially, the court began to develop a skeptical view not only toward the opinions of the scientific experts but also toward their data—not because nature could lie, but because its representatives could." Golan at 909. "More and more often, both parties called skilled witnesses and these witnesses began to be seen as both partisan and partial, serving the interest of the party who called them. The battle of the experts had begun." Mnookin at 770; see also *id*. at 772. See also e.g., J.H. Wigmore, "To Abolish Partisanship Of Expert Witnesses, as Illustrated in the Loeb-Leopold Case," 15 JOURNAL OF THE AMERICAN INSTITUTE OF CRIMINAL LAW AND CRIMINOLOGY 341 (1924). Wigmore's solution was to have experts summoned only by the court (as of yore); or have them address an impartial expert tribunal. Kenneth Weiss, "John H. Wigmore on the Abolition of Partisan Experts," 43 J. AM. ACAD. PSYCHIATRY LAW 21 (2015). See also, e.g., Stephan Landsman, "One Hundred Years of Rectitude: Medical Witnesses at the Old Bailey, 1717-1817," 16 LAW & HIST. REV. 445, 484 (1998) ("When an expert was perceived as an advocate, whether for conviction or acquittal, he or she was likely to be subjected to sharp attack. It was fine for barristers to be partisans—that was their assigned role. It was, however, perceived as dangerously provocative for experts to assume such an attitude. Experts might be used for partisan ends but they were expected to avoid becoming advocates themselves").

[105] "The most frequent comments pick up on perceived failures in preparation or on actions that the jurors saw as confirming their suspicions of experts as "professional witnesses." Scott E. Sundby, "The Jury As Critic: An Empirical Look at How Capital Juries Perceive Expert and Lay Testimony" 83 VA. L. REV. 1109, 1131 (1997) (reporting results of surveys of jurors).

[106] See generally, e.g., Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 Ariz. L. Rev. 851, 882 (2021).

[107] Hume is discussed at e.g. Frederick Schauer, et al., "Probabilistic Causation In The Law," Univ Va. Public Law and Legal Theory Paper Series 2020-43, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3599418. David Hume discusses causation and related issues in his A TREATISE OF HUMAN NATURE 121 *ff*. (Pelican 1969 ed.) and ENQUIRES 60 *ff.* (ed. L.A. Selby-Bigge 2d ed. 1921). Concerns with causation go back to Aristotle, and before. 2 THE ENCYCLOPEDIA OF PHILOSOPHY 56-66 (Paul Edwards ed., 1967, 1972).

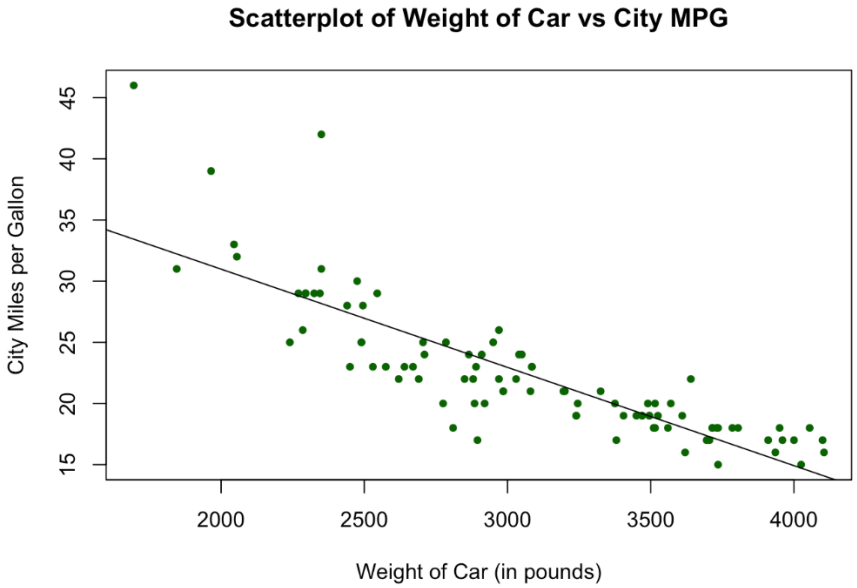
departure from the status quo, an intervention, shown by factors that somehow 'stand out' from the background of what we take to be context. I noted this some years ago:

> In the abstract, the law provides no good answers to these questions [of proximate cause], because no general rule exists on how to pick, out of the infinite mass of all possible factors, the one (or two) on which legal blame is fixed. To illustrate, imagine that a factory burns to the ground when a match is lit and ignites the surroundings. Obviously the match, and the person who lit it, are the cause of the destruction. But assume this is a match-testing factory, in which for years billions of matches have been tested in a fire-proof room filled with inert gases. A mistake is made, oxygen leaks in and the factory explodes. We have the same causes at play, but we are tempted to identify as the "cause" not the match, but rather the gas leak.[108]

Obviously this routine, lay sense of causation will not do for our scientific experts. So experts and commentators have turned to other techniques, but each poses problems. This section looks at three related approaches which have been used to postulate causation based on presumably scientific surveys and data: multiple linear regression, the Bradford Hill "viewpoints" or criteria, and relative risk (RR).

2.11.1 Multiple linear regression

Simple linear regression considers two variables, such as SAT scores and college grades, and plots a "best fit" line which measures the correlation between the variables. Imagine a scatter plot of values, SAT scores plotted against grades for, say 100 people. The straight line is plotted across the 100 points, minimizing the distance – to the extent possible as among all points--between the line and the points. Here's one estimating the correlation between the weight of cars and their miles per gallon:



The deviations –the distance between points and the line—are "residuals," and the size of the residential is a measure of the correlation between the two values, e.g., SAT scores and grades. If there

[108] Curtis E.A. Karnow, "Liability for Distributed Artificial Intelligences," 11 BERKELEY TECH. L.J. 147, 175–76 (1996) (note omitted). For a superb, classic discussion of the practical complexity of causation, see Charles Perrow, NORMAL ACCIDENTS: LIVING WITH HIGH-RISK TECHNOLOGIES (1984).

are essentially no or little residuals, the correlation (measured as the "correlation coefficient"[109]) is high. The line can be extrapolated, and used to predict: one inputs a new value for, say SAT score (the so-called explanatory or independent variable), and then reads, off the line, the corresponding value for grades (the response, or dependent variable). So much for simple linear regression.

Multiple linear regression, or multiple regression, uses two or more independent, or explanatory, variables, and generates results that show the impact one of them will have, holding the other constant, on the dependent or response variable. So in an example found at Investopedia,[110] the price of an oil stock (say, ExxonMobil) depends on the overall market, the price of oil, interest rates, prices of oil futures, the prices of other oil stocks, and so on. Multiple regression would show the correlation of one factor, holding the others constant. "Multiple linear regression is used to assess the relationship between two variables while taking into account the effect of other variables. By taking into account the effect of other variables, we cancel out the effect of these other variables in order to isolate and measure the relationship between the two variables of interest. This point is the main difference with simple linear regression."[111]

The danger is that we might take *multiple* regression to be an indication of causation, because multiple regression seems to select, from a series of other factors, the most important or significant factor. For example, if death rates are plotted against a series of independent variables such as weight, diet, exposure to asbestos, residence in Mediterranean countries, age of parents at death, and so on, and if one of those independent variables (say, diet) clearly has the best fit, we might be tempted to say that [bad] diet increases the odds of death.[112] This is fallacious, as pernicious a conclusion as the false correlations noted above, at e.g., § 2.10.4.4.7.

Correlations, even strong correlations can be explained by a variety of factors aside from causation. There may be confounding factors. For example, assume people who consume a lot of olive oil live longer. Olive oil may not be the cause of long life; it may be that people who consume olive oil live in Mediterranean climates, or are richer with better access to health case, than people who don't. The climate, or access to health care are confounding factors.

Multiple regression can tease out the impact of some confounding factors—but only if they are identified by the investigator. Indeed, this is one of the central weaknesses of multiple regression: that variables are selected by the investigator in advance, and others perforce are left out. The selected variables will have been deemed to be likely or "plausible"[113]—and of course must be variables for

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[109] https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

[110] https://www.investopedia.com/terms/m/mlr.asp

[111] https://statsandr.com/blog/multiple-linear-regression-made-simple/#multiple-linear-regression/. A nice video on this is at https://youtu.be/zITIFTsivN8

[112] Perhaps that's the logic in this article: "Multiple regression analysis could help test the causal relationship, if any, between the growing popularity of GBS [Google book search] and any increases or decreases in the sales or profits of specific publishers. Ideally, a particular publisher's performance would be compared to the level of GBS views of its books, and the effect of the number of views then tested for causation after the effects of all other variables have been controlled." Hannibal Travis, "Estimating the Economic Impact of Mass Digitization Projects on Copyright Holders: Evidence from the Google Book Search Litigation," 57 J. COPYRIGHT SOC'Y U.S.A. 907, 943–44 (2010) (notes omitted).

[113] Note, "Constitutional Risks to Equal Protection in the Criminal Justice System," 114 HARV. L. REV. 2098 (2001) ("plausible non-racial explanations" shown by multiple regression to not account for disparities).

which the investigator has the data. Multiple regression will not test for variables the investigator doesn't know about, or for which she can't find good data.

Next, if the independent variables used in multiple regression (e.g., the overall market, the price of oil, interest rates, prices of oil futures, the prices of other oil stocks) are highly correlated with one another *anyway*, multiple regression analysis will be useless. For example, the variables identified by Investopedia may well be correlated *anyway*, and the significant "cause" may be something else, perhaps the amount of oil exported by the OPEC nations. (Ironically, that's exactly what Investopedia advises.[114]) If that's so, multiple regression limited to those other variables (price of oil, and of oil futures etc.) cannot even help *identify* a potential cause, because the cause isn't even in the mix. Or there may be outliers—data points that are far distant from the best fit line,[115] which will skew it.[116] There are a lot of ways multiple regression can go wrong.[117] But the point here is simply that multiple regression is no better than linear regression—and that in turn is no better than simple correlation—at establishing causation.

2.11.2 Bradford Hill[118]

In 1965, Sir Austin Bradford Hill published nine "viewpoints" to help determine if observed epidemiologic associations are causal. Since then, the "Bradford Hill Criteria" have become a frequently cited framework for causal inference in epidemiologic studies.[119]

Bradford Hill spoke of these as "viewpoints" and not "criteria," to emphasize that these did not constitute a checklist, but something more general, i.e., considerations to assess causation.[120] The viewpoints are:

1. demonstration of a strong association between the causative agent and the outcome,
2. consistency of the findings across research sites and methodologies,
3. demonstration of specificity of the causative agent in terms of the outcomes it produces,

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[114] https://www.investopedia.com/ask/answers/012715/what-causes-oil-prices-fluctuate.asp#:~:text=tumble%20in%20prices.-,Supply%20and%20Demand%20Impact,true%20when%20demand%20outpaces%20supply.

[115] Technically with multiple regression the graphic will show, for two independent variables (and so three variables altogether), a plane rather than a line. This can be seen at e.g., https://towardsdatascience.com/graphs-and-ml-multiple-linear-regression-c6920a1f2e70, mapping three variables miles per gallon, weight of car, and horsepower. For three independent variables, a space can be displayed; and with four or more independent variables we have a higher order dimensional space which is difficult or impossible to visualize. These details don't matter here because as the text notes, the point is simply that both simple and multiple regression do no more than display correlation, not causation.

[116] https://sciencing.com/disadvantages-linear-regression-8562780.html

[117] https://online.stat.psu.edu/stat462/node/88/ A terrific video—a real caution on using multiple regression-- is provided by Professor Richard Nesbitt. https://www.edge.org/video/the-crusade-against-multiple-regression-analysis. https://www.edge.org/video/the-crusade-against-multiple-regression-analysis. See also https://www.edge.org/conversation/richard_nisbett-the-crusade-against-multiple-regression-analysis

[118] I am indebted to my friend and colleague Judge Harold Kahn for alerting me to the significance of this issue, and some of the key cases.

[119] K.M. Fedak, et al., "Applying the Bradford Hill criteria in the 21st century: how data integration has changed causal inference in molecular epidemiology," 12 EMERG THEMES EPIDEMIOL. 14 (2015), doi:10.1186/s12982-015-0037-4

[120] https://link.springer.com/article/10.1007/s10654-020-00703-7

4. demonstration of the appropriate temporal sequence, so that the causative agent occurs prior to the outcome,
5. demonstration of a biological gradient, in which more of the causative agent leads to a poorer outcome,
6. demonstration of a biologic rationale, such that it makes sense that the causative agent causes the outcome,
7. coherence of the findings, such that the causation argument is in agreement with what we already know,
8. experimental evidence, and
9. evidence from analogous conditions.[121]

"Bradford Hill criteria [are] a framework for considering whether a substance causes a disease." *Johnson & Johnson Talcum Powder Cases*, 37 Cal.App.5th 292, 303 & n.4 (2019). Although there are many hundreds of law review and journal articles on these viewpoints, only one California case, the *Johnson & Johnson Talcum Powder* case just cited, says anything useful. The other two opinions which mention Bradford Hill are *Boeken v. Philip Morris, Inc.,* 127 Cal. App. 4th 1640, 1650 (2005), which doesn't discuss the criteria, and the opinion it superseded, *Boeken v. Philip Morris Inc.,* 19 Cal. Rptr. 3d 101, 112 (2004), vacated, 127 Cal. App. 4th 1640 (2005), to the same effect.

There are a few red flags in any Bradford Hill analysis: (i) weighing and (ii) predicate association, which in turn implicates (iii) statistical validity.

2.11.2.1 *Weighing*

The list of viewpoints does not tell us how to weigh them,[122] so "courts are to apply these criteria flexibly."[123] In various cases, some viewpoints will be more important than others,[124] and so "two different experts applying the same criteria may reach two different opinions on causation, namely, one for a cause-and-effect relationship and the other against such a relationship. This often makes it difficult to exclude expert testimony on the grounds that an expert did not faithfully apply the criteria, since application of the criteria to epidemiology studies, as well as the weight given to each criterion after application, is largely subjective."[125] The "'weight of the evidence,' can be implemented in multiple

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[121] E.g., Robert van Reekum et al., "Applying Bradford Hill's Criteria for Causation to Neuropsychiatry," 13 JOURNAL OF NEUROPSYCHIATRY AND CLINICAL NEUROSCIENCES 318 (2001), doi.org/10.1176/jnp.13.3.318. See generally, David Spiegelhalter, THE ART OF STATISTICS: HOW TO LEARN FROM DATA 114 *ff.* (2021); FEDERAL JUDICIAL CENTER, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 599–600 (3d ed. 2011).

[122] G. Swean, et al, "A weight of evidence approach to causal inference," 62 JOURNAL CLINICAL EPIDEMIOLOGY 270 (2009), https://www.uc.pt/en/fmuc/phdhs/Courses/Epidemiology/A_weight_of_evidence_approach_to_causal_inference.pdf

[123] Neal C. Stout, "Judging the Reliability of Expert Causation Opinions Based on Epidemiology Data After King v. Burlington Northern Santa Fe Railway Company: Is the Judge A Gatekeeper or A Matador?," 43 CREIGHTON L. REV. 1049, 1068 (2010).

[124] Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 ARIZ. L. REV. 851, 885 (2021).

[125] Derek C. Smith et. al., "Statistically Significant Association: Preventing the Misuse of the Bradford Hill Criteria to Prove Causation in Toxic Tort Cases," 86 DEF. COUNS. J. 1, 4 (2019). One wonders if the result of such a subjective approach (assuming Smith is right) should lead to admissibility, as the article suggests, or to the opposite. The expert's weighing process must have been "based on methods and procedures of science*, rather than on*

ways." *In re Zoloft (Sertraline Hydrochloride) Prod. Liab. Litig.,* 858 F.3d 787, 795 (3d Cir. 2017). Thus showing that the guidelines were used, alone, isn't good enough; the

> "techniques" used to implement the analysis must be 1) reliable and 2) reliably applied. In discussing the conclusions produced by such techniques in light of the Bradford Hill criteria, an expert must explain 1) how conclusions are drawn for each Bradford Hill criterion and 2) how the criteria are weighed relative to one another.

In re Zoloft (Sertraline Hydrochloride) Prod. Liab. Litig., 858 F.3d 787, 796 (3d Cir. 2017). Thus expert opinion relying on the Bradford Hill guidelines has been excluded for failure to explain this weighing. *In re Mirena Ius Levonorgestrel-Related Prod. Liab. Litig. (No. II),* 341 F. Supp. 3d 213, 248-49 (S.D.N.Y. 2018), *aff'd sub nom. In re Mirena IUS Levonorgestrel-Related Prod. Liab. Litig. (No. II*), 982 F.3d 113 (2d Cir. 2020) (internal quotes omitted); *In re Incretin-Based Therapies Prod. Liab. Litig*., 524 F. Supp. 3d 1007, 1043 (S.D. Cal. 2021), aff'd, No. 21-55342, 2022 WL 898595 (9th Cir. Mar. 28, 2022); *Daniels-Feasel v. Forest Pharms., Inc*., No. 17 CV 4188-LTS-JLC, 2021 WL 4037820, at *15 *ff*. (S.D.N.Y. Sept. 3, 2021) (appeal filed); *In re Viagra (Sildenafil Citrate) & Cialis (Tadalafil) Prod. Liab. Litig.,* 424 F. Supp. 3d 781, 797 (N.D. Cal. 2020). The requirement to explain weighing parallels *Sargon*'s requirements that (i) opinion not be based on conjecture, (ii) the jury be able to "evaluate" the basis of the opinion, and (iii) the judge deciding admissibility knows the "reasons" for the opinion. *Sargon Enterprises, Inc. v. Univ. of S. California*, 55 Cal. 4th 747, 770, 771 (2012).[126]

Experts also run into trouble when they discuss only a few of the Bradford Hill viewpoints. *In re Nexium Esomeprazole,* 662 F. App'x 528, 530 (9th Cir. 2016). See also e.g*., In re Zoloft (Sertraline Hydrochloride) Prod. Liab. Litig*., 858 F.3d 787, 796 (3d Cir. 2017) (expert "must explain 1) how conclusions are drawn for each Bradford Hill criterion…."). It is worth emphasizing that while the expert may need to address all factors, it does not *necessarily* follow that all factors equally, or indeed all factors, support the causation hypothesis.[127]

2.11.2.2 *Predicate Association*

As the very first viewpoint implies, (demonstration of a strong association between the causative agent and the outcome), the Bradford Hill viewpoints cannot be applied, at all, unless and until a statistically significant correlation (or association) has been shown between the injury or disease on the one hand, and the proffered cause, on the other. That is, while these notes have warned that association must not be mistaken for causation, that association is a prerequisite to the application of the Bradford Hill causation analysis. The viewpoints apply "only *after* a study finds an association to determine whether that association reflects a true causal relationship." *In re Lipitor (Atorvastatin Calcium) Mktg., Sales*

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subjective belief or unsupported speculation*." In re Zoloft (Sertraline Hydrochloride) Prod. Liab. Litig.,* 858 F.3d 787, 796 (3d Cir. 2017) (emphasis supplied). The "weighing of that evidence must not be arbitrary, but must itself be based on methods of science*." In re Mirena Ius Levonorgestrel-Related Prod. Liab. Litig. (No. II),* 341 F. Supp. 3d 213, 248 (S.D.N.Y. 2018*), aff'd sub nom. In re Mirena IUS Levonorgestrel-Related Prod. Liab. Litig. (No. II*), 982 F.3d 113 (2d Cir. 2020) (internal quotes omitted).

[126] Similarly, in federal courts the application of the Bradford Hill viewpoints is considered to be governed by, or an instance of, the general *Daubert* requirements of reliability. E.g., *In re Zoloft (Sertraline Hydrochloride) Prod. Liab. Litig*., 858 F.3d 787, 797 (3d Cir. 2017); *Wendell v. GlaxoSmithKline LLC,* 858 F.3d 1227, 1235 (9th Cir. 2017); *Sarkees v. E. I. Dupont De Nemours & Co.,* 15 F.4th 584, 592 (2d Cir. 2021).

[127] Susan Haack, "Proving Causation: The Holism of Warrant and the Atomism of Daubert," 4 J. HEALTH & BIOMEDICAL L. 253, 276 (2008).

Pracs. & Prod. Liab. Litig. (No II) MDL 2502, 892 F.3d 624, 640 (4th Cir. 2018); *In re Lipitor (Atorvastatin Calcium) Mktg., Sales Pracs. & Prod. Liab. Litig*., 174 F. Supp. 3d 911, 924 (D.S.C. 2016) (same, statistically significant association must be show); *Soldo v. Sandoz Pharms. Corp*., 244 F. Supp. 2d 434, 569 (W.D. Pa. 2003); *Novelozo v. BP Expl. & Prod. Inc*., 2022 WL 1460103, at *7 (E.D. La. May 9, 2022); *Murphy v. BP Expl. & Prod. Inc*., 2022 WL 1460093, at *7 (E.D. La. May 9, 2022).[128]

> As the court in *McMunn v. Babcock & Wilcox Power Generation Group* [No. CIV.A. 10-143, 2013 WL 3487560, at *15 (W.D. Pa. July 12, 2013)] explained, the use of the Bradford Hill criteria is a two-step process. "Step one looks to whether there is a statistically significant association between a substance and a specific disease." If no such association exists, "the analysis should end there." If one does exist, "the second step applies the Bradford Hill criteria to assess whether the relationship is causal."

Derek C. Smith et. al., "Statistically Significant Association: Preventing the Misuse of the Bradford Hill Criteria to Prove Causation in Toxic Tort Cases," 86 DEF. COUNS. J. 1, 7–8 (2019) (notes omitted). One way to demonstrate causation is a *relative risk* assessment. Id., 86 Def. Couns. J. at 6. I discuss that below.

2.11.2.3 *Statistical Validity.*

The predicate demonstration of correlation must be statistically valid. E.g., *In re Lipitor (Atorvastatin Calcium) Mktg., Sales Pracs. & Prod. Liab. Litig*., 174 F. Supp. 3d 911, 924 (D.S.C. 2016). There are many ways in which correlation might be shown, including relative risk (which is discussed next), but all of these ways are susceptible to the negligent and sometimes maliciously sloppy way in which studies are done or subsequently analyzed. See above, §§ 2.10.4.4 *ff*.

> Textbooks of epidemiology explain how to calculate population attributable fractions, attributable risks, burden-of-disease estimates, and probabilities of causation from relative risk (RR) ratios. Despite their suggestive names, these association-based measures have no necessary connection to causation if the associations on which they are based arise from bias, confounding, p-hacking, coincident historical trends, or other noncausal sources.[129]

So it is that chance, bias, fraud, p-hacking, and so on, discussed above at §§ 2.10.4.4 *ff*. of this guide, may fatally infect the foundational opinion of statistical significance—even when the discussions of the Bradford Hill factors as such seem perfectly persuasive.[130]

But here too there are nuances. Statistical significance is a slippery notion. It is measured by reference to a so-called "p-value" which by convention is set at a certain number, but which may be set at a different number. (More details are provided at § 2.10.4.4.3 of this guide.) Perhaps the lack of statistical

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[128] See also, Derek C. Smith et. al., "Statistically Significant Association: Preventing the Misuse of the Bradford Hill Criteria to Prove Causation in Toxic Tort Cases," 86 DEF. COUNS. J. 1, 5 (2019); Frank C. Woodside, III et al., "The Bradford Hill Criteria: The Forgotten Predicate," 35 T. JEFFERSON L. REV. 103, 106 (2013).

[129] Louis Anthony Cox Jr., "Modernizing the Bradford Hill criteria for assessing causal relationships in observational data," 48 CRITICAL REVIEWS IN TOXICOLOGY 682 (2018) (abstract) DOI: 10.1080/10408444.2018.1518404, https://www.tandfonline.com/doi/abs/10.1080/10408444.2018.1518404

[130] A nice video on this is found on YouTube: Greg Martin, "Causality. Why you shouldn't use Bradford Hill criteria!," https://youtu.be/0JV1orh1QGE

significance is not necessarily fatal to a Bradford Hill analysis. *In re Lipitor (Atorvastatin Calcium) Mktg., Sales Pracs. & Prod. Liab. Litig. (No II) MDL 2502*, 892 F.3d 624, 641 (4th Cir. 2018).

2.11.3 Relative Risk

The notion of relative risk (RR) is cited in a number of cases, although sometimes without explanation.[131] Its focus is specific, not general, causation.[132] The point is to estimate the odds that a person's disease or injury was caused by the proffered agent, and to do so from epidemiological data, that is, data attributable not to the person, but to a group of people (the "population").

The central concept here is that an RR of 1.0 means there is no difference between the risk to the exposed person and of the control group; an RR of 2.0 implies a 50% probability that the agent was a cause. RR could be less than 1, implying the exposure *reduces* risk.[133]

A good way to understand the role of this "2.0" is offered by Spiegelhalter. Recall that a disease will be contracted by *some* people in the control group anyway; the issue is what *additional* risk is posed by the putative agent. Imagine that normally 10 men out of 1000 get lung cancer. If asbestos exposure more than doubles the risk (2.0), then if the 1000 men were exposed to asbestos, we'd expect [say] 25 cases; less than half of the 25 would have developed cancer if they had not been exposed, i.e. more than ½ of the cancers were caused by exposure. If John is one of the 25 with cancer, the odds are over 50% that John's cancer was caused by the exposure.[134]

Thus, the notion of RR is intimately tied to the usual test of causation in civil law, i.e., that causation is proved to be more probable than not. We will return to this issue below, questioning this relationship between the RR and the preponderance test.

Here's how a court describes RR, quoting an authoritative text:

> "When statistical analyses or probabilistic results of epidemiological studies are offered to prove *specific* causation ... under California law those analyses must show a relative risk greater than 2.0 to be 'useful' to the jury. [Citations] This is so, because a relative risk greater than 2.0 is needed to extrapolate from generic population-based studies to conclusions about what caused a specific person's disease. When the relative risk is 2.0, the alleged cause is responsible for an equal number of cases of the disease as all other background causes present in the control group. Thus, a relative risk of 2.0 implies a 50% probability that the agent at issue was responsible for a particular individual's disease. *This means that a relative risk that is greater than 2.0 permits the conclusion that the agent was more likely than not responsible for a particular individual's disease*. [Reference Manual on Scientific Evidence (Federal Judicial Center 2d ed. 2000) (Ref.Manual),] *Ref. Manual* at 384, n. 140 (citing *Daubert II*)." (*In re Silicone Gel Breast Impl. Prod. Liab. Lit.* (C.D.Cal.2004) 318 F.Supp.2d 879, 893; italics added.)

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[131] *Lockheed Litigation Cases*, 115 Cal.App.4th 558, 562 (2004); *McManaway v. KBR, Incorporated,* 852 F.3d 444, 455 n.12 (5th Cir. 2017).

[132] Michael D. Green et al., "Reference Guide on Epidemiology," ANNOTATED REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 333, 384.

[133] https://sphweb.bumc.bu.edu/otlt/mph-modules/ep/ep713_association/ep713_association3.html

[134] David Spiegelhalter, THE ART OF STATISTICS: HOW TO LEARN FROM DATA 116-117 (2021).

Cooper v. Takeda Pharmaceuticals America, Inc., 239 Cal.App.4th 555, 593–594 (2015). See also e.g., *Cottle v. Superior Court*, 3 Cal.App.4th 1367, 1401 n.4 (1992) ("'Relative risk' is simply the ratio of the incidence of disease in the exposed population to the incidence of disease in the non-exposed population.'" (Citation omitted).[135]

As noted above, RR is one (although not the only) way to show the predicate for the application of Bradford Hill factors. E.g., *In re Johnson & Johnson Talcum Powder Prod. Mktg., Sales Pracs. & Prod. Litig.,* 509 F. Supp. 3d 116, 162 (D.N.J. 2020).

2.11.3.1 *Terminology*

Some cases suggest RR can be measured as *among* potential causes, such as between one type of asbestos and another, for example reporting an expert's opinion that one was "three times more potent" than another, or 10 times, or "500 times as toxic" and seemingly referring to this is as "relative risk," *Phillips v. Honeywell Internat. Inc*. 9 Cal.App.5th 1061, 1067 & n.5 (2017). This is not the way *Cooper*, quoted above, and other authorities mean it: They refer to risk compared to the general population or other control group, not to people affected by some other suspected agent. (*Cooper* also refers to RR as a statistically "significant hazard ratio," *Cooper*, 239 Cal.App.4th at 594 n.18, which seems unobjectionable). "Risk ratio" may also be properly used.[136] Another case says that a 2.7 "relative risk," means the person was "2.7 times more likely to contract" the disease in question. *Hines v. Youseff, 914* F.3d 1218, 1235 (9th Cir. 2019). But this might be confusing. For example, a RR of 1.5 doesn't mean the person is 1.5 more likely to contract the disease: because it's less than 2.0, the RR means it is *not* more probable that the person will, as compared to control group , contract the disease as a result of the proffered agent.[137]

2.11.3.2 *Cautions*

RR studies must be analyzed carefully to ensure they meet the usual standards: we want to be sure the affected and control groups are similar, in the pertinent ways—and what "pertinent" implies will differ from study to study[138]—so that there are no confounding factors.[139] It's essential there be no bias, no p-

[135] "The threshold for concluding that an agent was more likely than not the cause of an individual's disease is a relative risk greater than 2.0. Recall that a relative risk of 1.0 means that the agent has no effect on the incidence of disease. When the relative risk reaches 2.0, the agent is responsible for an equal number of cases of disease as all other background causes. Thus, a relative risk of 2.0 (with certain qualifications noted below) implies a 50% likelihood that an exposed individual's disease was caused by the agent. A relative risk greater than 2.0 would permit an inference that an individual plaintiff's disease was more likely than not caused by the implicated agent. A substantial number of courts in a variety of toxic substances cases have accepted this reasoning." Michael D. Green et al, "Reference Guide on Epidemiology," in Michael Saks, et al., ANN. REFERENCE MANUAL ON SCI. EVID. 333 (2d ed.) 2004 WL 48155, 50. See also Mark Parascandola, "What Is Wrong with the Probability of Causation?," 39 JURIMETRICS J. 29, 32 (1998).

[136] Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 ARIZ. L. REV. 851, 880 (2021).

[137] Other pitfalls in terminology are found at https://sphweb.bumc.bu.edu/otlt/mph-modules/ep/ep713_association/ep713_association3.html

[138] Fashioning a control group is often driven by assumptions including those about the cause of the disease—the very issue to be decided by the study. Do we require a general population to be the control group? All men and women? Adults over or below an age? Below a specific body mass index? Do we need a control group with similar "background" such as wealth, education, proximity to power plants, or similar genetic makeup? Every choice

hacking, a large enough sample, random sampling, accurate measurement and repeatability,[140] and so on; all issues discussed elsewhere in this guide. These usual criteria include sensitivity to the confidence interval of the studies, the "magnitude of possible error," especially if the RR is very close to the desired threshold (e.g., 2.0). *Brock v. Merrell Dow Pharm., Inc.,* 874 F.2d 307, 312 (5th Cir.), *modified on reh'g*, 884 F.2d 166 (5th Cir. 1989) ("it is important to remember that the confidence interval attempts to express mathematically the magnitude of possible error, due to the above mentioned sources as well as others, and therefore a study with a relative risk of greater than 1.0 must always be considered in light of its confidence interval before one can draw conclusions from it").

And when some studies support the calculation of RR and others don't, the expert may be required to explain her choice of studies on which she relied. *Milward v. Rust-Oleum Corp*., 820 F.3d 469, 474–475 (1st Cir. 2016).

Finally, relying on single study is highly problematic, although it is not clear if this is an issue for the judge evaluating admissibility, or for the jury weighing the consequent opinion. "A relative risk greater than 2.0 is less persuasive if there is only a single study supporting it; if the methods used in multiple studies suffer from significant validity problems; if other bodies of research, such as toxicological studies, fail to support the underlying plausibility of the cause-and-effect claim; or if the lower confidence bound for the true relative risk from a comprehensive meta-analysis falls well below 2.0."[141]

2.11.3.3 *Connection to burden of proof*

As noted the 2.0 RR is used because it seems to reflect the "more probable than not" burden of proof the plaintiff has to show causation. See generally, e.g., *Petitpas v. Ford Motor Co.,* 13 Cal.App.5th 261, 299 (2017) (plaintiff must show to a reasonable medical probability that asserted case was a substantial factor); *Gideon v. Johns-Manville Sales Corp*., 761 F.2d 1129, 1137 (5th Cir. 1985) (preponderance standard); *Kline v. Zimmer, Inc*., 79 Cal. App. 5th 123, __ (2022) (same); *Jennings v. Palomar Pomerado Health Sys., Inc.,* 114 Cal. App. 4th 1108, 1118 (2003) (same).

But it's not clear that RRs of *less* than 2.0 are irrelevant. The opinion in *Johnson & Johnson Talcum Powder Cases*, 37 Cal.App.5th 292, 325 & n.13 (2019) notes both authoritative cases suggesting 2.0 is indeed a prerequisite, as well as serious criticisms of that approach. The opinion declines to take a formal position on the matter but approvingly notes the use of RRs below 2.0 as "support" for an expert opinion together with other bases, even if those studies could not alone be a basis for the opinion. 37 Cal.App.5th at 326. See *Pritchard v. Dow Agro Scis.,* 705 F. Supp. 2d 471, 486 (W.D. Pa. 2010), *aff'd,* 430

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reflects an assumption about which variables are likely or unlikely to affect the calculation of RR. See e.g., Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 ARIZ. L. REV. 851, 910 (2021).

[139] David A. Freedman & Philip B. Stark, "The Swine Flu Vaccine and Guillain-Barre Syndrome: A Case Study in Relative Risk and Specific Causation," LAW & CONTEMP. PROBS. 49 (Autumn 2001) ("Suppose that the exposed and unexposed groups in an epidemiologic study are similar except for the exposure of interest, so that confounding is not an issue").

[140] https://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated/4-measurement-error-and-bias

[141] Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 ARIZ. L. REV. 851, 896–97 (2021). The profound risks of relying on a single study are noted in my "Scientific Evidence: Grand Theories And Basic Methods," CORNELL L.REV. (online, forthcoming 2022), preprint at https://works.bepress.com/curtis_karnow/53/

F. App'x 102 (3d Cir. 2011) (noting conflicts between courts permitting or barring use of studies showing RR under 2.0).

There are studies; and there are studies. Some are more reliable than others; perhaps accepting a RR under 2.0 is reasonable for well-designed studies, and not for other studies such as case-control studies[142] or animal studies.[143] "A poorly designed study may suggest a high relative risk, and a well-designed study may show a low relative risk."[144]

A kindred issue is this: as suggested above a RR value without a confidence interval is useless; but by the same token the RR can be increased or decreased by expanding or contracting the confidence interval.[145]

> So, the courts' frequent quotation that "where a confidence interval contains a relative risk of 1.0, the results of the study are not statistically significant" means only that at a P-value of 0.05 (or 95% significance level, or confidence interval), no effect was one of the values included. Other values will be included, depending on the width of the confidence interval. At a lower (say 90%) confidence interval, the interval may include only relative risks greater than one. Interpreting the confidence interval is not a dichotomous choice, any more than is statistical significance. It is a description of the study, not a dichotomous signal.[146]

Setting aside the ambiguity inherent in a RR of e.g. 2.0 [or some other number], there is a deeper issue, whether we should insist that each of many bases for an expert opinion itself be more probable than not in order for the opinion to pass muster. There actually doesn't seem to be a technical reason for that insistence. "[N]othing in the Federal Rules or the *Daubert* trilogy indicates the preponderance of the evidence standard was to be applied to individual pieces of scientific evidence. Thus, judges who apply a relative risk 2.0 standard exclude valid scientific evidence on which experts would rely outside the courtroom."[147]

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[142] Joseph Sanders et. al., "Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science," 63 ARIZ. L. REV. 851, 897–98 (2021).

[143] Mark Parascandola, "What Is Wrong with the Probability of Causation?," 39 JURIMETRICS J. 29, 35–36 (1998). Certain animal studies were not a reliable basis for opinion in *Gannon v. United States,* 292 F. App'x 170, 174 (3d Cir. 2008).

[144] Mark Parascandola, "What Is Wrong with the Probability of Causation?," 39 JURIMETRICS J. 29, 42 (1998).

[145] Erica Beecher-Monas, "Lost in Translation: Statistical Inference in Court," 46 ARIZ. ST. L.J. 1057, 1070 (2014). Studies can't test the entire population; they examine samples. "Confidence intervals" measure the degree of certainty that the sampling accurately shows the true population value (i.e., as if one has actually tested the entire population). By convention, confidence levels of 95% or 99% are used. https://www.investopedia.com/terms/c/confidenceinterval.asp. A 95% confidence interval is a range of values that one may be 95% confident contains the population's value. For example, a 95% confidence interval with a 4 percent margin of error means that the statistic will be within 4 percentage points of the real population value 95% of the time. As sample size increases, the range of interval values narrows, and one will estimate the true population value with more accuracy, compared with a smaller sample. https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/margin-of-error/. See e.g., examples provided at https://www.health.ny.gov/diseases/chronic/confint.htm. For more, see the discussion of statistics in the appendix to this guide.

[146] Erica Beecher-Monas, "Lost in Translation: Statistical Inference in Court," 46 ARIZ. ST. L.J. 1057, 1070 (2014).

[147] George Horvath, "Federal District Court Decisions on the Admissibility of Expert Witness Testimony: An Empirical Study and A Revision of the Conventional Narrative in the Toxic Tort Context," 88 U. CIN. L. REV. 515, 537–38 (2019).

This is not an easy problem. On the one hand, if we knew the expert had 12 bases for her opinion and all of them were unreliable, we would be sorely tempted to simply bar the opinion. After all, zero plus zero is zero.

Relying on a series of studies all of which have flaws seems foolish; certainly that's what the trial judge in *Cooper* thought as he rejected the consequent opinion. But he was reversed, because the appellate court thought that each study had something—not zero—and together the studies were adequate because the expert, an authority in the area, said they were adequate. *Cooper v. Takeda Pharms. Am., Inc.,* 239 Cal. App. 4th 555, 591 (2015). Setting aside the somewhat circular logic of relying on an expert to tell us if we should rely on him, we can see how this could work: One may have a dozen pieces of evidence, each weak, but if they are truly independent, relying on different data and using different techniques, perhaps together they may be highly probative. Perhaps we have different studies each with a problem: animal studies, case control studies, studies with small samples, studies without double blind administration, studies which don't account for a confounding factor, and so each of which is alone a patently insufficient basis for opinion[148]--but suppose every single one of them points in the same direction. Is that enough for an opinion?

But still, this begs the question of under which conditions such an opinion, even if admissible based on studies with an RR under 2.0, is admissible. How close to 2.0 should the bases be? What sort of supporting studies or data should an expert have? These questions, like the RR = 2.0 standard itself, are unresolved, and are likely to remain so.

2.12 Pattern evidence

There are problems with some traditional forensics which focus on discerning patterns between known and unknown samples. Experts use "feature-comparison" methods, and compare for example DNA samples, bite marks, latent fingerprints, firearms' marks, footwear, tire tracks and hair. Some of these techniques are so obvious, some courts have said, that there is no risk that juries will be fooled; so a *Kelly* hearing is not needed: the "reliability of the process is readily apparent." *People v. Venegas*, 18 Cal. 4th 47, 80 (1998) (internal quotations omitted); *People v. Cowan*, 50 Cal. 4th 401, 470 (2010). (These opinions, being as they were issued in the *Kelly* context, probably meant that the *extent* of the reliability of the tests are obvious to the jury.)

But many of these tests are not reliable and they have led to wrongful convictions. "[F]orensics that were once considered unassailable are subject to serious doubt.[4"] *Gimenez v. Ochoa*, 821 F.3d 1136, 1144 (9th Cir. 2016). The court's footnote 4, a comprehensive list of sources pertaining to this issue, is reproduced in this note.[149] Four months after *Gimenez* was decided, the President's Council of Advisors

[148] Experts can rely on inadmissible evidence; FRE 703, E.C. § 801 (b): studies with an RR below 2.0 might be inadmissible, but that doesn't tell us if it is proper for experts to rely on them.

[149] "In 2009, the National Research Council submitted a comprehensive report to the U.S. Department of Justice critiquing the state of forensic science. See Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council, Strengthening Forensic Science in the United States: A Path Forward 57 (2009), available at https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf ("In some cases, substantive information and testimony based on faulty forensic science analyses may have contributed to wrongful convictions of innocent people."). The popular press and legal academia have regularly reported research breakthroughs debunking or seriously undermining forensics disciplines once thought to be scientifically sound. See, e.g., Brandon

on Science and Technology (PCAST) issued a detailed Report confirming the problem.[150] The PCAST Report discusses forensic "feature-comparison" methods such as the analysis of DNA, hair, latent fingerprints, firearms and spent ammunition, toolmarks and bitemarks, shoeprints, tire tracks, and handwriting. The Report particularly criticizes bitemark evidence, firearms analysis (done to determine if a bullet is associated with a specified firearm), footwear and hair comparisons. In these areas, experts make subjective findings and there are few or no studies suggesting a valid scientific basis for the opinions on pattern matching.

The very notion of 'similarity' is vague, as it leaves unanswered the essential question- 'similar in what respect?' Chairs and tables are similar in that they are furniture and made of wood, but dissimilar because only one is used for sitting.[151] In most of the pattern matching forensic areas, there is no consensus on exactly which features or aspects should be at issue, how closely the match must be, nor is there a theoretical basis, or experimental confirmation, for the number and type of criteria that are used. Some of the vagueness of e.g., hair and tire track evidence can be seen in opinions:

L. Garrett & Peter J. Neufeld, Invalid Forensic Science Testimony & Wrongful Convictions, 95 Va. L.Rev. 1 (2009) (reviewing trial records to determine the incidence of experts overstating the probative value of various forensic disciplines); Jennifer L. Mnookin, The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate, 7 Law, Probability & Risk 127 (2008); Kelly Servick, Reversing the Legacy of Junk Science in the Courtroom, Science (Mar. 7, 2016), http://www.sciencemag.org/news/2016/03/reversing-legacy-junk-science-courtroom (hair analysis, bite mark analysis, fingerprint comparisons); NPR Staff, Arson Forensics Sets Old Fire Myths Ablaze, National Public Radio (Nov. 19, 2011), http://www.npr.org/2011/11/19/142546979/arson-forensics-sets-old-fire-myths-ablaze (arson and burn pattern analysis); John Solomon, FBI's Forensic Test Full of Holes, Wash. Post (Nov. 18, 2007), http://www.washingtonpost.com/wp-dyn/content/article/2007/11/17/AR2007111701681_pf.html (comparative bullet-lead analysis). Other sub-fields have been roundly criticized for relying on questionable methodology or for overstating the probative value of forensic analysis. Michael Hall, False Impressions, Tex. Monthly (Jan. 2016), http://www.texasmonthly.com/articles/false-impressions/ (bite mark analysis); Spencer S. Hsu, Va. Exoneration Underscores Mounting Challenges to Bite–Mark Evidence, Wash. Post (Apr. 8, 2016), https://www.washingtonpost.com/local/public-safety/va-exoneration–underscores–to–mounting–challenges–to–bite–mark-evidence/2016/04/08/55bbfe98–fd9a–11e5–886f–a037dba38301_story.html (reporting the exoneration of a sailor convicted of rape and murder based on bite-mark analysis); Spencer S. Hsu, FBI Admits Flaws in Hair Analysis Over Decades, Wash. Post (Apr. 18, 2015), https://www.washingtonpost.com/local/crime/fbi-overstated-forensic-hair–matches–in–nearly–all–criminal–trials–for–decades/2015/04/18/39c8d8c6–e515–11e4–b510–962fcfabc310_story.html?tid=a_inl ("The Justice Department and FBI have formally acknowledged that nearly every examiner in an elite FBI forensic unit gave flawed testimony in almost all trials in which they offered evidence [about hair matches] against criminal defendants over more than a two-decade period."); Adam Liptak, You Think DNA Evidence is Foolproof? Try Again, New York Times (Mar. 16, 2003), http://www.nytimes.com/2003/03/16/weekinreview/the-nation-you-think-dna-evidence-is-foolproof-try-again.html; Jim Hilbert, "The Disappointing History of Science in the Courtroom: Frye, Daubert, and the Ongoing Crisis of 'Junk Science' in Criminal Trials" 71 OKLA. L. REV. 759, 805 (2019).

[150] Report To The President: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods, https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf. Comments and discussions on the Report are found at http://for-sci-law.blogspot.com/2016/11/index-to-comments-and-cases-discussing.html?m=0. See also, Jennifer L. Mnookin, "The Uncertain Future of Forensic Science," 147 DAEDALUS 99 (Fall 2018).

[151] See Curtis Karnow, "Similarity In Legal Analysis & The Post-Literate Blitz," 15 GREEN BAG 2D 243 (2012).

> Two tire tracks were consistent with a Yokohama 382 tire, and one tire track was consistent with an Armstrong Ultra Trac tire, which were the types of tires defendant had on his van at the time of this homicide.
> …
> A hair found on Ferguson's arm was similar to defendant's head hair. Fibers found on her body were *similar to* the red acetate lining, the white nylon insulation, and the white acrylic insulation
>
> *People v. Suff*, 58 Cal. 4th 1013, 1022–23 (2014) (emphasis supplied).

2.12.1 Hair comparison

Hair comparison evidence is particularly squirrely. The FBI has testified repeatedly in trials in this area, and a study found errors in over 90% of 268 trials reviewed. In those, more than 35 defendants were sentenced to death. As of April 2015, 14 of those defendants had been executed or died in prison.[152]

2.12.2 Bitemark comparison

Bitemark evidence is unreliable.[153] As the PCAST Report notes, "available scientific evidence strongly suggests that examiners cannot consistently agree on whether an injury is a human bitemark and cannot identify the source of [a] bitemark with reasonable accuracy."[154]

2.12.3 Fingerprints

Fingerprint evidence receives a more favorable review in the PCAST Report, and most courts that have looked at this deem it admissible. E.g., *People v. Rivas*, 238 Cal. App. 4th 967, 976 (2015), relying on Judge Posner's opinion in *United States v. Herrera,* 704 F.3d 480 (7th Cir. 2013). Posner's justification for it is that all sorts of evidence is admissible in a spectrum from scientific DNA evidence to the "less rigorous" fingerprint evidence, to eye witness identification which is not scientific at all. In what is at best a tepid endorsement, Judge Posner compares fingerprint opinion to eye witnesses, and notes that the "increasingly well documented fallibility of eyewitness testimony… has not banished it from criminal trials." *Herrera*, 704 F.3d at 486.[155] Perhaps the real reason fingerprint evidence is accepted is that that

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[152] https://www.fbi.gov/news/pressrel/press-releases/fbi-testimony-on-microscopic-hair-analysis-contained-errors-in-at-least-90-percent-of-cases-in-ongoing-review

[153] Michael J. Saks, et al., "Forensic bitemark identification: weak foundations, exaggerated claims," 3 *Journal Of Law and the Biosciences* 538 (Oxford: 2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5570687/. See also, http://blog.expertpages.com/expertwitness/bite-mark-expert-witness-recants-testimony-opens-door-for-death-row-appeal.htm

[154] See also, "Bite-mark analysis can lead to false convictions, landmark research shows" January 8, 2016 https://www.sciencedaily.com/releases/2016/01/160108134949.htm

[155] In 2002, the widely respected Judge Louis Pollak (disclosure: I'd earlier clerked for him) filed an opinion barring the government's experts from "present[ing] 'evaluation' testimony as to their 'opinion' (Rule 702) that a particular latent print is in fact the print of a particular person." *United States v. Llera Plaza*, 188 F. Supp. 2d 549, 552 (E.D. Pa. 2002). The FBI's approach did not meet the standards of *Daubert v. Merrell Dow Pharmaceuticals, Inc.,* 509 U.S. 579 (1993) or *Kumho Tire Co., Ltd. v. Carmichael,* 526 U.S. 137 (1999). There was an outcry from the Department of Justice. D.H. Kaye, "The Nonscience Of Fingerprinting: United States V. Llera-Plaza," 21 QUINNIPIAC L. REV. 1073 (2003). Based on reconsideration and some new evidence, Judge Pollak reversed himself. *Llera Plaza*, 188 F. Supp. 2d at 575. As in *Crisp*, citied in the text, it's been suggested the reason was in effect that this type of evidence has been given "for over a century without anyone proving that [the experts] make many mistakes," D.H.

it has been for so long. *U.S. v. Crisp*, 324 F.3d 261, 268–269 & n.3 (4th Cir. 2003) (also noting existence of standards and some evidence of a zero error rate, relying on *U.S. v. Havvard,* 260 F.3d 597, 599 (7th Cir. 2001; dissenting Judge Michael found this insufficient to admit fingerprint evidence, as it does not meet the *Daubert* standard).

Daniel Kahneman and his colleagues have discussed the failures of fingerprint analysis and pattern evidence more generally.[156] They note the PCAST report, as well as the specific cognitive fallacies which result in readings which are both (i) biased, by which the readings show error in some consistent way, as well as (ii) subject to "noise" by which readings are subject to error in almost random ways. 'Experts' disagree with each other—and with their own prior result. This is a sobering read.

2.12.4 Handwriting

Although the PCAST report does not highlight expert handwriting analysis—a pattern-matching process like the others above—there are some grounds to doubt the validity of that sort of evidence:

> From the perspective of published empirical verification, handwriting identification expertise is almost nonexistent. Nor is it an area, like practical plumbing, in which the results of correct or incorrect practice would be obvious to by-stander and practitioner alike. Rather, it is exactly the kind of situation in which it is easiest to fool oneself and others. If handwriting expertise were offered for the first time today with this published record as its foundation, courts would almost certainly reject it.

D. Michael Risinger, "Exorcism of Ignorance As A Proxy for Rational Knowledge: The Lessons of Handwriting Identification 'Expertise,'" 137 U. PA. L. REV. 731, 739–740 (1989) (note omitted). Another commentator writes, "no meaningful evidence of reliable testing exists to prove the validity of handwriting analysis." Simone Ling Francini, "Expert Handwriting Testimony: Is the Writing Really on the Wall?," 11 SUFFOLK J. TRIAL & APP. ADVOC. 99, 114 (2006). See Brandon L. Garrett & Gregory Mitchell, "The Proficiency of Experts" 166 U. PA. L. REV. 901, 937 (2018) (summarizing studies showing high error rate, lack of empirical support for the supposed expertise, etc.).

Handwriting expert testimony is in principle admissible in California courts. M. Simons, CALIFORNIA EVIDENCE MANUAL § 8:10 (2020); 1 B. Witkin, CALIFORNIA EVIDENCE, "Handwriting and Typewriting" § 67 (5th ed. 2019) quoting *People v. Graves*, 64 C.2d 208, 211 nb.2 (1966) ("The possibility that one person could imitate the handwriting of another and successfully deceive an expert document examiner is very remote"); *People v. Lucas*, 60 Cal.4th 153, 224 (2014), disapproved on separate issue by *People v. Romero and Self*, 62 Cal.4th 1 (2015). It is, too, in federal courts. *U.S. v. Crisp* 324 F.3d 261, 270 (4th Cir. 2003) (survey of various federal circuits). *Crisp*'s rationale, severely questioned by the dissent, is illustrative: the evidence is admissible because (i) it has long been so[157] and (ii) experts, presumably handwriting experts, say so. *Crisp*, 324 F.3d at 271.

Kaye, op cit. at 1087. But the original opinion remains a particularly troubling indictment of the fingerprint evidence.

[156] Daniel Kahneman, Oliver Sibony & Cass Sunstein, NOISE (2021) at 7, 245 ff.

[157] A number of commentators have observed the continuing use of pattern evidence based simply on long-standing practice. See this article on the felt peer pressure among judges to continue in this vein. Katie Kronick, "Forensic Science and the Judicial Conformity Problem," 51 SETON HALL L. REV. 589, 594 (2021).

Other courts have gone beyond this, stating that the expertise is, generally speaking, reliable*. U.S. v. Prime,* 431 F.3d 1147, 1153 (9th Cir. 2005). Criticism that handwriting expertise is not a science has been met with the judicial observation that this is actually *correct*, and so it need not meet scientific criteria, but rather something less, a lesser sort of 'specialized knowledge' and as such is admissible. *United States v. Mallory,* 902 F.3d 584, 594 (6th Cir. 2018); Andrew Sulner, "Critical Issues Affecting the Reliability and Admissibility of Handwriting Identification Opinion Evidence-How They Have Been Addressed (or Not) Since the 2009 Nas Report, and How They Should Be Addressed Going Forward," 48 SETON HALL L. REV. 631, 701 (2018) (urging same non-science standard).[158]

2.12.5 Firearms

As to firearms identification, in a series of studies (which may be applicable to other pattern evidence), the decision of the jury to accept the opinion appears a function of the words used by experts to express their opinion and different approaches to cross examination. Paraic Scanlon, et al., "Juror Certainty About Expert Firearms Identification Evidence and the Impact of Cross-Examination," 31 SO.CAL. INTERDISC. L.J. 91, 93 (2021).

In the course of dealing with large number of objections to a death penalty judgment, the state Supreme Court endorsed the admission of tool mark evidence, apparently on the basis that (i) the evidence, analogized to bite mark evidence, was not used to show a person made the mark, but that a tool made the mark; and (ii) that, as to the expert's training, "while there was no formal training on tool mark analysis, Sperber would have been the type of expert to have received such training if it existed." *People v. Parker*, 13 Cal.5th 1 (2022), 2022 WL 1573859, at *24. The expert was found to have sufficient qualifying experience. These reasons do not seem to address the problem of pattern evidence discussed above, problems the court itself noted.

2.12.6 Pattern evidence and admissibility under *Kelly*

In late 2020, a California appellate court was faced with the claim that firearms tool marks evidence was shown to be no longer reliable and so should no longer be admissible under *Kelly*. The court noted "legitimate criticism from credible sources: scientific reports commissioned by the federal government, and testimony by a research scientist. That evidence undermines the reliability of the method and casts some doubt on the prosecution expert's conclusion that particular bullet casings came from the same firearm." *People v. Azcona,* 58 Cal. App. 5th 504, 512 (2020, modified Jan. 11, 2021). But because the "defendant did not meet his burden to show that a clear majority of the relevant scientific community no longer accepts the method as reliable," the court held it admissible (although it remanded for other reasons relating to this expert opinion). Id. at 512. The jury would weigh the weaknesses in the evidence. More detail on this case is in this footnote.[159]

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[158] There are actually many *different* sorts of things handwriting experts do, and their success rate varies substantially. See the meta-study at D. Michael Risinger, "Appendix: Cases Involving the Reliability of Handwriting Identification Expertise Since the Decision in Daubert," 43 TULSA L. REV. 477, 484 (2007). Some of the weakness in federal courts' approach to handwriting analysis, post *Daubert* and post *Kumho Tire*, is found in the Risinger's entertaining "Goodbye to All That, or A Fool's Errand, by One of the Fools: How I Stopped Worrying About Court Responses to Handwriting Identification (and "Forensic Science" in General) and Learned to Love Misinterpretations of Kumho," 43 TULSA L. REV. 447, 475 (2007).

[159] *Azcona* is a peculiar case, perhaps in part because it may have alternative holdings. The problem with the pattern evidence was raised by the defendant as a *Kelly* issue, and the court found (with the concurring opinion disagreeing on this point) that the "defendant did not meet his burden to show that a clear majority of the

As *Azcona* itself says, pattern evidence such as firearms and tool marks likely isn't a *Kelly* issue. Jurors are "capable of understanding and evaluating" an expert walking the jury through the similarity between two sets of marking, and the techniques "did not have any particular heightened power to dazzle the jury," *People v. Lund*, 64 Cal.App.5th 1119, 1137, 1138, 1142 (2021) (discussing computer hash tag comparisons).

But perhaps we may take a pause here, as did *Azcona*, to consider how previously admissible evidence under *Kelly* would be found *in*admissible, i.e., understanding how courts end reliance on previously accepted evidence when it's shown to be, in fact, unreliable.

Azcona does not tell us how to measure a "clear majority of the relevant scientific community." One would first have to define the community. *People v. Joehnk,* 35 Cal. App. 4th 1488, 1505 (1995). A recent case on DNA evidence (specifically, STRmix) decided that the relevant community was not that of computer software engineers despite the role of computer-aided analysis which is central to the creation of the evidence. *People v. Davis* (2022) 75 Cal.App.5th 694, 721 (2022). Rather, the community comprised the FBI and "numerous forensic laboratories," *id*. at 717.

Too, the community must be well qualified. A "mere majority support or opposition is of little value if the persons voicing fair support or opposition are minimally qualified to state such an opinion." Elia V. Pirozzi, CALIFORNIA GUIDE TO CRIMINAL EVIDENCE, "Expert opinion" Ch. 2 § 11 (2021 ed.) *citing People v. Venegas*, 18 Cal. 4th 47, 85 (1998). "[U]nanimity of views in the scientific community is not required," *People v. Yorba,* 209 Cal. App. 3d 1017, 1023 (1989). But if at least a "majority" is needed, then one presumably must be able to *count* the number of people in the community. How does one do that?

> What percentage of acceptance constitutes "generally accepted" has never been clearly delineated. … Standards such as "widespread, prevalent and extensive" or a "substantial segment of the scientific community" have been used. Other questions such as whether a proponent of evidence must establish the general acceptance of both the scientific technique and the underlying theory, or how many and what type of experts are required to show general acceptance also remain unanswered.

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relevant scientific community no longer accepts the method as reliable." Thus the pattern evidence was admissible. Because it was raised as a *Kelly* issue, the court did not review whether the evidence was "reliable," as would have happened in federal court, that is, it refused to impose a generic reliability test for this supposedly scientific evidence. Then the court found that the issue probably was not a *Kelly* matter at all, because the jury could on its own (presumably using its "common sense") figure out the reliability of the pattern evidence: "It is not clear that the technique employed here is subject to the *Kelly* standard at all, as visual comparison of marks on physical objects is not so foreign to everyday experience that jurors would have unusual difficulty evaluating it." 58 Cal. App. 5th at 511. Having opined that the issue likely was not controlled by *Kelly*, and was subject to the usual reliability standards, the court noted that there was considerable evidence that undermined the reliability of the methods, but left the issue to the jury, id. at 512—despite the fact, unremarked by the court, that the trial judge (following the lead of counsel) had not reviewed reliability but, probably erroneously, applied the *Kelly* test. In a final irony, the court seems to endorse the admission of the evidence under *Kelly* (which it had said was probably inapplicable) --- which requires a previous published California opinion endorsing the scientific technique -- even though the majority and the concurrence agreed *they could not find any such published opinion,* because the parties mistakenly thought there *was* such a published opinion. 58 Cal.App.5th at 511 notes 1 & 6.

Cassandra C. Colchagoff, "A New Era for Science and the Law: The Face of Scientific Evidence in the Federal Courts After Daubert v. Merrell Dow Pharmaceuticals, Inc.," 29 TULSA L.J. 735, 741 (1994) (notes omitted).[160]

But perhaps one need not count: only a "a consensus drawn from a typical cross-section of the relevant, qualified scientific community" is needed. *People v. Leahy*, 8 Cal. 4th 587, 612 (1994). This focus, though, swaps one problem for another: figuring out what is "typical" when there is disagreement. Typicality of views and a consensus are, practically, the same thing.

It remains unclear how to demonstrate that a previously accepted technique is no longer reliable.

3. Selected Motions

Aside from their use at trial, experts play a prominent role in class action certification motions, and at summary judgment/adjudication motions. This section collects some authorities and issues on expert issues unique to these proceedings, and notes potential problems in anti-SLAPP motions.

3.1 Class Certification

A certification motion is peculiar, and that has raised some issues on the extent to which evidence in support and against the motion should be admissible in the same way as it is at trial. Generally speaking, a certification motion undertakes a showing that despite e.g. 10,000 plaintiff class members, pretrial and trial procedures can be managed: that at trial liability and damages can either be proven on a class-wide basis because the same facts apply to all class members, or because the individual issues can otherwise be managed efficiently; for example the court will not have to have a two day mini-trial for each of, say, 10,000 class members. In that light, one might say that the showing should be that at the time of trial, there will be a certain assortment of admissible evidence supporting each element of the claim; in this light, it is may not be material that the admissible evidence is presented at the time of certification, and indeed much of the evidence is not literally presented at that time. So it is that a few courts have held that it is not necessary at a certification motion to establish the admissibility of expert testimony forecast for trial. *In re Zurn Pex Plumbing Products Liability Litigation*, 644 F.3d 604, 611, 613 (8th Cir. 2011). Other courts disagree and do require that showing at the certification stage. *In re Blood Reagents Antitrust Litigation*, 783 F.3d 183, 187–188 (3d Cir. 2015). A Ninth Circuit panel seems to agree with the Eighth Circuit, to the dismay of other members of the court. *Sali v. Corona Regional Medical Center,* 907 F.3d 1185, 1189–1190 (9th Cir. 2018) (dissent from refusal to hear case en banc), see also brief on certiorari, *Corona Regional Medical Center v. Sali*, 2019 WL 1490163 (U.S.), *pet. cert. dismissed, Corona Regional Medical Center v. Sali,* 139 S.Ct. 1651 (2019).

[160] "Does the general acceptance test require a majority vote in a Gallup Poll of scientists?" Christopher O. Eriksen, "Expert Science Fiction: A Comment on Rubanick v. Witco Chemical Corp.," 45 RUTGERS L. REV. 165, 190 (1992). The term "overwhelming majority of the scientific community," is used, in various related contexts (not just *Kelly*), with great abandon. In one article, it refers to two professional articles and unnamed items "elsewhere." Neil Vidmar, "Juries and Expert Evidence," 66 Brook. L. Rev. 1121, 1122 (2001); Joshua T. Calo, "Deceptive Advertising or Evolving Science? How "Barefoot Running" Demonstrates Novel Strategies for Defending False Advertising Lawsuits Under State Deceptive Trade Practices Acts," 22 JEFFREY S. MOORAD SPORTS L.J. 529, 540 (2015) (citing 2 articles).

The issue in California was resolved in *Apple Inc. v. Superior Court,* 19 Cal.App.5th 1101, 1119–1120 (2018), which requires the same showing of expert admissibility at the certification stage as at trial. In *Apple*, the trial court postponed the admissibility question to trial and was reversed: The appellate court noted the proffered expert opinions were unsatisfactory because one of them was on an economic issue for which the witness was unqualified, and the other opinion was "purely conclusory." The expert provided no explanation or analysis and an "unknown methodology is the equivalent of no methodology…." *Apple*, 19 Cal. App. 5th at 1122. There are many other examples of certification being denied because the expert declarations were insufficient. A promise to do a needed statistical study was insufficient:

> The trial court also rejected Modaraei's expert witness's proposal to conduct statistical analysis *after* class certification to reach a conclusion about tasks class members performed and how much time they spent performing those tasks. "[A] promise to conduct a statistical analysis in the future is not a trial plan," the trial court said. [¶] We agree with the trial court's analysis.

Modaraei v. Action Prop. Mgmt., Inc., 40 Cal. App. 5th 632, 644 (2019). To be sure, the promise of a study is not enough, but many courts would accept something less than the full-blown study itself. For example pilot studies, which demonstrate the feasibility of a full study sufficient to show that the issue can be handled as a statistical matter, have been approved. *Bell v. Farmers Ins. Exch*., 115 Cal. App. 4th 715, 723 (2004); *Duran v. U.S. Bank Nat'l Assn*., 59 Cal. 4th 1, 22, 325 P.3d 916, 927 (2014) (parties failed to conduct pilot study); Weil & Brown, et al., CALIFORNIA PRACTICE GUIDE: CIVIL PROCEDURE BEFORE TRIAL ¶ 14:98b (Rutter: 2022).

A different problem arises when the expert's study is sufficiently presented, but the expert showing doesn't actually obviate the problem of individual issues overwhelming the common proof. This can be problem when statistical studies are designed to establish liability, because the defense will usually claim that it still has the right to call individual class members to cross examine them. For example, in *McCleery v. Allstate Ins. Co*., 37 Cal. App. 5th 434, 453–54 (2019), the court found the science behind the survey to be arguably valid, but because the responses to the survey were to be anonymous, there was no way the defense might be able to cross examine the survey respondents. So the trial plan incorporating the survey proposal did not support certification. A similar problem was identified in *Duran v. U.S. Bank Nat'l Assn.,* 19 Cal. App. 5th 630, 646 (2018) (witnesses outside of expert's sample could be called to support affirmative defenses).

Judges in certification motions are fact finders: They may weigh evidence, and reject testimony (such as expert declarations) because while admissible, they are weak, or outweighed by other evidence. See generally, *Modaraei v. Action Prop. Mgmt., Inc.,* 40 Cal. App. 5th 632, 642 (2019); *Benton v. Telecom Network Specialists, Inc.*, 220 Cal. App. 4th 701, 728 (2013); *Sav-On Drug Stores, Inc. v. Superior Court*, 34 Cal. 4th 319, 334 (2004). So it is interesting to review *ABM Indus. Overtime Cases*, 19 Cal. App. 5th 277, 295–97 (2017) where the trial judge was reversed in part because he applied too stringent a test and found an expert declaration inadmissible. A later opinion explained the appellate outcome in part saying there had been no formal objection to the expert or motion to strike his declaration, nor had his deposition been taken. *Duran v. U.S. Bank Nat'l Assn*., 19 Cal. App. 5th 630, 650 n.17 (2018). But the trial judge in a case can admit a declaration as an evidentiary matter, and then decline to rely on it if it is weak or improbable.

3.2 Summary Judgment

The risks of not having an expert differ as between trial and summary judgment. This is discussed above, in section 2.1's first paragraph.

The existence of a standard of care may be presented in a summary judgment or adjudication motion. Typically, this requires expert evidence. Where the moving party does not have an adequate declaration, it fails to satisfy its initial burden, as when the expert fails to explain the standard of care and no factual basis for the opinion is provided. There is no evidentiary value at all to an expert opinion which does not state what facts are relied on, for example merely referring to "experience and documented medical literature." *Lowery v. Kindred Healthcare Operating, Inc.,* 49 Cal. App. 5th 119, 124–25 (2020). Ultimate facts and conclusions, even if unopposed, are insufficient to carry the initial burden of the moving party. *Doe v. Good Samaritan Hosp*., 23 Cal. App. 5th 653, 664 (2018); accord, *McAlpine v. Norman*, 51 Cal. App. 5th 933, 939 (2020).

Where negligence would be obvious to a layperson, no expert is needed to show duty based on a standard of care, or its breach, such as in an ordinary or professional negligence case. *Ryan v. Real Estate of the Pac., Inc.,* 32 Cal. App. 5th 637, 645 (2019) (reversing grant of summary judgment). By the same token, if an expert is needed for the moving party, the opposing party generally better have an adequate contrasting expert declaration in order to stave off summary judgment. If the opposing expert's declaration only contains conclusory opinion, and if it has no reasoned explanation linking factual predicates to the ultimate opinion, then the opinion is inadequate and will not defeat the summary judgment motion. *Fernandez v. Alexander*, 31 Cal. App. 5th 770, 782 (2019); *Andrews v. Foster Wheeler LLC*, 138 Cal. App. 4th 96, 108 (2006).[161]

The issue of having adequate responsive experts is not confined to opinions on standard of care. In an asbestos case, the moving defendant offered an expert opinion that the product (talc) did not contain asbestos. Plaintiff's opposition did not have an expert declaration. Instead, it included only attorney declarations with hundreds of pages of exhibits such as snippets of survey results with a small sample size, many items not relevant to the pertinent period of time, none of which had "specific facts" needed to rebut the expert opinion. Also, plaintiffs never asked to depose the defense expert. Summary judgment was affirmed. *LAOSD Asbestos Cases,* 44 Cal.App.5th 475 (2020).

And in a twist on these principles, there may be the peculiar case in which an expert is needed to establish that no expert is needed. The facts arose in *Webster v. Claremont Yoga,* 26 Cal. App. 5th 284, 287 (2018). Plaintiff was injured by the yoga teacher's manipulations; the defense had an expert on the

[161] A caution on "duty" as such: this is generally a matter of law for the court, and not of fact, and expert opinion would not be relevant. *O'Neal v. Stanislaus County Employees' Retirement Assn.,* 8 Cal.App.5th 1184, 1215 (2017); *Ballard v. Uribe,* 41 Cal.3d 564, 572 (1986) (court should decide duty*); Walker v. Sonora Regional Medical Center*, 202 Cal.App.4th 948, 965 (2012) (expert opinion irrelevant where the law specified duty). "We reject Andrighetto's attempt to establish a triable issue of fact on the duty of care issue by relying on opinions from an expert. The existence and the scope of a duty of care in a given factual situation are issues of law for the court." *Vulk v. State Farm General Insurance Company*, 69 Cal.App.5th 243, 259 n.6 (2021). The existence of a duty and its scope in a given case, of course, depend on facts. For example, whether there is a 'special relationship' between the parties is a legal issue. E.g., *Brown v. USA Taekwondo*, 11 Cal.5th 204, 209 (2021); *Regents of University of California v. Superior Court*, 4 Cal.5th 607, 619 (2018). But the existence of the duty depends on the facts which may, or may not, be disputed in a summary judgment motion. *Luebke v. Automobile Club of Southern California,* 59 Cal.App.5th 694, 706 (2020); *Jones v. Awad*, 39 Cal.App.5th 1200, 1208 (2019) (homeowners owe duty of care to visitor).

standard of care indicating the adjustments were within the standard. Plaintiff argued in effect that there was no standard of care and the negligence was obvious from e.g., the injures. The court suggested that because how yoga instructors do their work is not within common understanding of the public, experts are needed, and "As for plaintiff 's contention that the yoga instruction industry has no uniform standard of care, she cites no evidence to support her contention; indeed, an expert would be needed on this point as well."

There is another twist, apparently unique to governmental design immunity. Where a plaintiff sues alleging a dangerous condition of a public entity's property, the public entity can sustain its burden on summary judgment with expert testimony in support of "design immunity," i.e., that the design which resulted in the injury was reasonable (among some other factors). Even if a plaintiff has expert testimony to contrary, design immunity still succeeds and no trial is necessary: summary judgment can be granted. *Menges v. Dep't of Transportation*, 59 Cal. App. 5th 13, 20 (2020) ("We are not concerned with whether the evidence of reasonableness is undisputed; the statute provides immunity when there is substantial evidence of reasonableness, even if contradicted") (internal quoted omitted).

As in any other expert setting, a declaration can be rendered inadmissible when the underlying facts are shown to be without evidentiary support, or simply speculative. *Sanchez v. Kern Emergency Med. Transportation Corp*., 8 Cal. App. 5th 146 (2017).

Perry v. Bakewell Hawthorne, LLC, 2 Cal. 5th 536 (2017) is an important case making it clear that the expert disclosure requirements (discussed in section 1 of this guide) which may bar the expert's testimony at trial also apply in the summary judgment context. So if there's been a triggering demand, and deadlines have passed for disclosure, only the properly disclosed experts on their disclosed topics may provide declarations on summary judgment. The issue won't be common because most summary judgment motions will be argued before the deadlines, but if for example a trial date has been continued (and discovery deadlines have not), the scenario may well arise. As the court noted, if a party needs to use an undisclosed expert, it can try for relief under e.g. CCP §§ 2034.610 (amendment of expert witness list) or 2034.720 (relief from untimely disclosure) and may seek a continuance of the summary judgment motion under CCP § 437c(h) in order to do so. 2 Cal. 5th at 541 n.6.[162]

Finally, under CCP § 437c(h) parties served with a summary judgment motion can seek further discovery. Sometimes the request for discovery can be justified by the service of the moving party's declarations, including expert declarations: the opposing party may then seek to depose the experts. *St. Mary Med. Ctr. v. Superior Court*, 50 Cal. App. 4th 1531, 1538–39 (1996).

3.3 Comment: Carving out the expert issue.

In many class certification and summary judgment motions, the central and decisive issue is the admissibility of an expert declaration. Summary judgment might for example focus on the scope of a duty, or whether there is support for the notion that a standard of care was met, and if an expert declaration is admissible then the issue must be relegated to trial. In certification motions, especially in the employment area, expert declarations are central to a showing that individual issues do not

[162] Note however that if the problem with the expert declaration is not that expert discovery mandates were violated but rather that the new declaration's opinions were not disclosed at deposition, then because the trial court may have discretion to admit the new opinions at trial, they may be admissible at the summary judgment stage as well. *Harris v. Thomas Dee Engineering Co., Inc.*, 68 Cal.App.5th 594, 602 (2021).

predominate and can be managed via e.g. a statistical analysis. E.g., *Duran v. U.S. Bank National Assn*., 59 Cal.4th 1, 39 (2014); *McCleery v. Allstate Ins. Co.,* 37 Cal.App.5th 434, 451 (2019); *Lampe v. Queen of the Valley Medical Center*, 19 Cal.App.5th 832, 843 (2018). Both of these sorts of motions are complicated and involve a very wide set of issues, both of fact and of law. As a case management issue, and working with the judge, the parties should consider severing out the expert admissibility issue for a separate hearing allowing the judge and the lawyers to concentrate their efforts on the decisive expert issue. This won't always work, especially in some class actions where the judge must carefully review briefs on the plaintiff's theory of the case to understand exactly how the individual issues might arise, e.g., *Bradley v. Networkers Internat., LLC*, 211 Cal.App.4th 1129, 1147 (2012); *Apple Inc. v. Superior Court,* 19 Cal.App.5th 1101, 1115 (2018), but it is worth consideration.[163]

3.4 Anti-SLAPP

Evidence is relevant under the second prong of an anti-SLAPP motion to strike, because plaintiff must then show the claims have some minimal merit. See generally, e.g., *Navellier v. Sletten*, 29 Cal.4th 82, 89; *Baral v. Schnitt*, 1 Cal.5th 376, 384–385 (2016). Many lawyers and judges up to 2019 were under the impression that only *admissible* evidence qualified. But in that year, the Supreme Court held otherwise, noting that the court could consider evidence which might be admissible at trial, even if it were technically inadmissible at the time of the anti-SLAPP motion. *Sweetwater Union High School Dist. v. Gilbane Building Co*., 6 Cal.5th 931, 948–949 (2019) (consider evidence when there is "no categorical bar to [admissibility of] statements" at trial). This evidentiary standard had been forecast in *Fashion 21 v. Coalition for Humane Immigrant Rights of Los Angeles*, 117 Cal.App.4th 1138 (2004), as *Sweetwater* notes.[164]

Significant expert opinions are uncommon in anti-SLAPP motions, but they do come up. E.g., *Nagel v. Twin Laboratories, Inc*., 109 Cal.App.4th 39, 52 (2003); *CKE Restaurants, Inc. v. Moore*, 159 Cal.App.4th 262, 272 (2008); cf., *Peregrine Funding, Inc. v. Sheppard Mullin Richter & Hampton LLP,* 133 Cal.App.4th 658, 687 (2005); *Abuemeira v. Stephens*, 246 Cal.App.4th 1291, 1296 (2016); cf. *Gaprindashvili v. Netflix, Inc.* (C.D. Cal., Jan. 27, 2022, No. 221CV07408VAPSKX) 2022 WL 363537, at *10 (chess experts).

This presents the issue of how to handle expert declarations which are inadmissible as filed in connection with the anti-SLAPP motion—and there are many reasons why this might be so. Perhaps the qualifications are unstated; perhaps the opinions are conclusory; perhaps the logical links among general theories, specific theory, case specific facts, and the ultimate opinion are not displayed; and so on. Sometimes it will be painfully obvious that the opinion will never be admitted; e.g., a doctor testifies on plumbing standards. But it is not clear how the trial court is to handle most objections to deficient expert declarations, because one can in most situations imagine how the foundational and other issues could be cured in the future at trial. As of this writing I have not located a published decision on the matter. One unpublished opinion rests on admissible lay opinion, and the demonstration of some

[163] For more on case management in complex cases, see my "Complexity in Litigation: A Differential Diagnosis" 18 U. PA. J. BUS. L. 1 (2015).

[164] As some have observed, *Sweetwater* both mandates admissible evidence and also allows inadmissible evidence (if possibly admissible later*). Musero v. Creative Artists Agency, LLC*, 72 Cal.App.5th 802, 816 n.6 (2021). For more on *Sweetwater*, see my "Projected Admissibility," *The Daily Journal* (March 18, 2019) https://works.bepress.com/curtis_karnow/36/

expertise, to endorse the use of the questioned opinion. *Sanderson v. Woodbridge Village Association*, 2020 WL 1429322, at *6 (Mar. 24, 2020, No. G056684).

4. **Appellate Review**.

Usually the best advice for trial judges is simply to rule as best they can, and let the chips fall where they may—years later—in the court of appeal. But trial judges care about the standard of review because if they have discretion but fail to exercise it, they are often reversed, *Platypus Wear, Inc. v. Goldberg*, 166 Cal.App.4th 772, 782 (2008); and if they do have discretion, the court of appeal will appreciate its display on the record, perhaps satisfied that the trial judge was not "arbitrary, capricious or patently absurd," to quote one of the many definitions of 'abuse of discretion.' *In re Marcelo B.,* 209 Cal. App. 4th 635 (2012). No one wants to be seen as patently absurd.

Evidentiary decisions are usually reviewed under this 'abuse of discretion' standard. Courts have held this extends to "trial court's ruling on the admissibility of expert testimony," *Easterby v. Clark,* 171 Cal. App. 4th 772, 778 (2009); *Cooper v. Takeda Pharm. Am., Inc.,* 239 Cal. App. 4th 555, 576 (2015) ("We review a court's execution of these gatekeeping duties for an abuse of discretion"); *Lockheed Litig. Cases*, 115 Cal. App. 4th 558, 564 (2004) (a trial judge's ruling that there is no reasonable basis for an expert opinion is subject to abuse of discretion standard); *People v. Jackson,* 221 Cal. App. 4th 1222, 1237 (2013); *San Francisco Print Media Company v. Hearst Corporation*, 44 Cal.App.5th 952, 962 & n.7 (2020).

The standard is infamously flexible. E.g., *Du-All Safety, LLC v. Superior Court*, 34 Cal. App. 5th 485, 495–96 (2019) (lengthy discussion concluding that the scope of discretion depends on the "applicable principles of law"). Without a pretty specific context, it is not possible to determine the extent to which the standard allows latitude to the trial court. *Miyamoto v. Department of Motor Vehicles*, 176 Cal.App.4th 1210, 1222-1225 (2009) (Rushing, P.J., concurring) ("At bottom the concept of 'discretion' is one of *latitude.* It means that on certain types of issues, the trial court's ruling will survive review even if the members of the reviewing court might have ruled otherwise"). See generally, Jon B. Eisenberg, et al., CALIFORNIA PRACTICE GUIDE: CIVIL APPEALS AND WRITS ¶ 8:90 (2021) ("Although easily summarized, the abuse of discretion standard is difficult to apply in a consistent manner. It has been characterized as "so amorphous as to mean everything and nothing at the same time and be virtually useless as an analytical tool"; and thus is criticized as failing to offer clearly defined, objective guidelines") (citations omitted).

The determining context may involve not only the type of decision at issue, but also the procedural context, e.g. summary judgment vs. trial. *Reid v. Google, Inc.,* 50 Cal. 4th 512, 535 (2010) ("we need not decide generally whether a trial court's rulings on evidentiary objections based on papers alone in summary judgment proceedings are reviewed for abuse of discretion or reviewed de novo"). In the summary judgment context, the courts are still not in agreement. *Howard Entm't, Inc. v. Kudrow*, 208 Cal. App. 4th 1102, 1122 (2012) ("Every single Court of Appeal decision in the past one-half decade has applied the abuse of discretion standard of review in the summary judgment context to admissibility of evidence contentions") (Turner, J., concurring); *contra*, *Pipitone v. Williams*, 244 Cal. App. 4th 1437, 1451 (2016) (de novo review); *id*. at n.20 (recognizing split in authority). See *Ducksworth v. Tri-Modal Distribution Servs*., 47 Cal. App. 5th 532, 543 (2020) (recognizing split and endorsing abuse of discretion standard); accord, *Wicks v. Antelope Valley Healthcare Dist*., 49 Cal. App. 5th 866, 875 (2020). Other opinions "merge" the standards, *Jennings v. Palomar Pomerado Health Sys., Inc.,* 114 Cal. App. 4th 1108,

1119 n.9 (2003) ("We view the standard of review issue in this case as one in which otherwise distinct standards of appellate review merge into a single approach").

Moreover the issue is complicated by the fact that where an appellate court affirms the court's ruling such as excluding an expert opinion because it relies only on speculation, the wording of the appellate ruling may well be that it finds no abuse of discretion; but if the trial court had gone the other way, it would have been reversed. *Dee v. PCS Prop. Mgmt., Inc.,* 174 Cal. App. 4th 390, 405 (2009); *Bozzi v. Nordstrom, Inc.,* 186 Cal. App. 4th 755, 762–63 (2010). That is, the appellate court does not mean that it would uphold the ruling as one of many reasonable orders; instead, there is only one correct ruling. There really wasn't any latitude at all.[165] It is difficult practically to distinguish this sort of standard of review from de novo review.

Cases that say they endorse the abuse of discretion standard *also* impose a de novo test at least "when the exclusion of expert testimony rests on a matter of statutory interpretation," *Du-All Safety, LLC v. Superior Court*, 34 Cal. App. 5th 485, 494–95 (2019); *Bos. v. Penny Lane Centers, Inc.*, 170 Cal. App. 4th 936, 950 (2009); *Lockheed Litig. Cases*, 115 Cal. App. 4th 558, 564 (2004). Of course, most decisions about experts can always be seen as 'resting' on matters of statutory interpretation because in each the court is usually somehow applying CCP §§ 2034 *ff*. or Evid. C. §§ 720-733, 800 *ff*. Especially when the issues are presented in motions such that the court of appeal literally has the same record as the trial court, the reviewing court may make de novo rulings regardless of the language it uses articulating the standard of review.[166] The Ninth Circuit, for example, reciting an abuse of discretion standard of review almost exactly as that articulated in state court opinions and noting the issue was a "close question," *still* reversed the trial judge. *Wendell v. GlaxoSmithKline LLC,* 858 F.3d 1227, 1233 (9th Cir. 2017).

It is difficult to extrapolate useful guidance from these cases.

There *are* some questions, however, that appear to depend on a variety of factors, or where there is no bright line test, such that a reviewing court might actually defer to a trial judge's view, despite the higher court's contrary assessment. For example, whether a party has acted reasonably, and so is entitled to ask for the exclusion of the other side's experts, or although having failed to meet the literal requirements of expert disclosure, a party nevertheless acted reasonably, both call for the exercise of trial court discretion based on what might be a myriad of factors including an assessment of practical prejudice. Too, an assessment whether a question at trial is fairly within the scope of both an expert disclosure and of deposition testimony (e.g., *Easterby v. Clark*, 171 Cal. App. 4th 772, 780 (2009)) calls for a practical approach trial judges are in the best position to undertake. And whether an expert is offering an opinion which is sufficiently beyond common experience (e.g., *People v. Robinson*, 37 Cal. 4th 592, 631 (2005); *People v. Jackson*, 221 Cal. App. 4th 1222, 1239 (2013)), given the almost infinite range of permissible expert topics, also seems an area where (often, if not always) reasonable people could differ, in turn suggesting deference to the trial court. E.g., *Allgoewer v. City of Tracy*, 207 Cal. App. 4th 755, 763 (2012) ("The facts of every case will determine whether expert testimony would assist the jury"). And it is rather clear that as a judge decides whether or not to invoke "inherent authority" (i.e.

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[165] An example of this, having nothing to do with experts, is found in e.g., *People v. N. River Ins. Co*., 48 Cal. App. 5th 226, 232 (2020), where although the standard is cited as "abuse of discretion" there was only one correct ruling.

[166] Eisenberg suggests that this is in fact the decisive factor: whether the court of appeal thinks it's in as good a position as the trial court to decide. Jon B. Eisenberg, et al., CALIFORNIA PRACTICE GUIDE: CIVIL APPEALS AND WRITS ¶ 8:92 (2021).

outside the constraints of CCP 2034.010 *ff*.) to exclude witnesses, the decision should be subject to an actual abuse of discretion standard. *Cottini v. Enloe Med. Ctr*., 226 Cal. App. 4th 401, 426 (2014).

One might also think that there is substantial area for reasonable disagreement on the sometimes difficult issue of deciding whether an expert's area of expertise is sufficiently close to the area on which she intends to give an opinion, *People v. Austin,* 219 Cal. App. 4th 731, 742 (2013) ("trial court is given considerable latitude") but there are cases such as *ABM Indus. Overtime Cases*, 19 Cal. App. 5th 277 (2018) which recite the abuse of discretion standard on that issue and readily find the judge abused his discretion.

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Appendices

California Code sections: Code of Civil Procedure (CCP) §§ 2034 ff.; Evidence Code (Evid. C.) §§ 720-733, 800 ff.

Summaries of selected published opinions on experts

Post *Sanchez* authorities

Resources: Experts, Statistics, Science & Bad Science

"Sargon and the Science of Reliable Experts," 22 *ABTL Report* 1 (Spring 2013)

CCP § 2034.010

This chapter does not apply to exchanges of lists of experts and valuation data in eminent domain proceedings under Chapter 7 (commencing with Section 1258.010) of Title 7 of Part 3.

CCP § 2034.210

After the setting of the initial trial date for the action, any party may obtain discovery by demanding that all parties simultaneously exchange information concerning each other's expert trial witnesses to the following extent:

(a) Any party may demand a mutual and simultaneous exchange by all parties of a list containing the name and address of any natural person, including one who is a party, whose oral or deposition testimony in the form of an expert opinion any party expects to offer in evidence at the trial.

(b) If any expert designated by a party under subdivision (a) is a party or an employee of a party, or has been retained by a party for the purpose of forming and expressing an opinion in anticipation of the litigation or in preparation for the trial of the action, the designation of that witness shall include or be accompanied by an expert witness declaration under Section 2034.260 .

(c) Any party may also include a demand for the mutual and simultaneous production for inspection and copying of all discoverable reports and writings, if any, made by any expert described in subdivision (b) in the course of preparing that expert's opinion.

CCP § 2034.220

Any party may make a demand for an exchange of information concerning expert trial witnesses without leave of court. A party shall make this demand no later than the 10th day after the initial trial date has been set, or 70 days before that trial date, whichever is closer to the trial date.

CCP § 2034.230

(a) A demand for an exchange of information concerning expert trial witnesses shall be in writing and shall identify, below the title of the case, the party making the demand. The demand shall state that it is being made under this chapter.

(b) The demand shall specify the date for the exchange of lists of expert trial witnesses, expert witness declarations, and any demanded production of writings. The specified date of exchange shall be 50 days before the initial trial date, or 20 days after service of the demand, whichever is closer to the trial date, unless the court, on motion and a showing of good cause, orders an earlier or later date of exchange.

CCP § 2034.240

The party demanding an exchange of information concerning expert trial witnesses shall serve the demand on all parties who have appeared in the action.

CCP § 2034.250

(a) A party who has been served with a demand to exchange information concerning expert trial witnesses may promptly move for a protective order. This motion shall be accompanied by a meet and confer declaration under Section 2016.040 .

(b) The court, for good cause shown, may make any order that justice requires to protect any party from unwarranted annoyance, embarrassment, oppression, or undue burden and expense. The protective order may include, but is not limited to, one or more of the following directions:

(1) That the demand be quashed because it was not timely served.

(2) That the date of exchange be earlier or later than that specified in the demand.

(3) That the exchange be made only on specified terms and conditions.

(4) That the production and exchange of any reports and writings of experts be made at a different place or at a different time than specified in the demand.

(5) That some or all of the parties be divided into sides on the basis of their identity of interest in the issues in the action, and that the designation of any experts as described in subdivision (b) of Section 2034.210 be made by any side so created.

(6) That a party or a side reduce the list of employed or retained experts designated by that party or side under subdivision (b) of Section 2034.210 .

(c) If the motion for a protective order is denied in whole or in part, the court may order that the parties against whom the motion is brought, provide or permit the discovery against which the protection was sought on those terms and conditions that are just.

(d) The court shall impose a monetary sanction under Chapter 7 (commencing with Section 2023.010) against any party, person, or attorney who unsuccessfully makes or opposes a motion for a protective order under this section, unless it finds that the one subject to the sanction acted with substantial justification or that other circumstances make the imposition of the sanction unjust.

CCP § 2034.260

(a) All parties who have appeared in the action shall exchange information concerning expert witnesses in writing on or before the date of exchange specified in the demand. The exchange of information may occur at a meeting of the attorneys for the parties involved or by serving the information on the other party by any method specified in Section 1011 or 1013 , on or before the date of exchange.

(b) The exchange of expert witness information shall include either of the following:

(1) A list setting forth the name and address of a person whose expert opinion that party expects to offer in evidence at the trial.

(2) A statement that the party does not presently intend to offer the testimony of an expert witness.

(c) If a witness on the list is an expert as described in subdivision (b) of Section 2034.210 , the exchange shall also include or be accompanied by an expert witness declaration signed only by the attorney for the party designating the expert, or by that party if that party has no attorney. This declaration shall be under penalty of perjury and shall contain all of the following:

(1) A brief narrative statement of the qualifications of each expert.

(2) A brief narrative statement of the general substance of the testimony that the expert is expected to give.

(3) A representation that the expert has agreed to testify at the trial.

(4) A representation that the expert will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning the specific testimony, including an opinion and its basis, that the expert is expected to give at trial.

(5) A statement of the expert's hourly and daily fee for providing deposition testimony and for consulting with the retaining attorney.

CCP § 2034.270

If a demand for an exchange of information concerning expert trial witnesses includes a demand for production of reports and writings as described in subdivision (c) of Section 2034.210 , all parties shall produce and exchange, at the place and on the date specified in the demand, all discoverable reports and writings, if any, made by any designated expert described in subdivision (b) of Section 2034.210 .

CCP § 2034.280

(a) Within 20 days after the exchange described in Section 2034.260 , any party who engaged in the exchange may submit a supplemental expert witness list containing the name and address of any experts who will express an opinion on a subject to be covered by an expert designated by an adverse party to the exchange, if the party supplementing an expert witness list has not previously retained an expert to testify on that subject.

(b) This supplemental list shall be accompanied by an expert witness declaration under subdivision (c) of Section 2034.260 concerning those additional experts, and by all discoverable reports and writings, if any, made by those additional experts.

(c) The party shall also make those experts available immediately for a deposition under Article 3 (commencing with Section 2034.410), which deposition may be taken even though the time limit for discovery under Chapter 8 (commencing with Section 2024.010) has expired.

CCP § 2034.290

(a) A demand for an exchange of information concerning expert trial witnesses, and any expert witness lists and declarations exchanged shall not be filed with the court.

(b) The party demanding the exchange shall retain both the original of the demand, with the original proof of service affixed, and the original of all expert witness lists and declarations exchanged in response to the demand until six months after final disposition of the action. At that time, all originals may be destroyed unless the court, on motion of any party and for good cause shown, orders that the originals be preserved for a longer period.

(c) Notwithstanding subdivisions (a) and (b), a demand for exchange of information concerning expert trial witnesses, and all expert witness lists and declarations exchanged in response to it, shall be lodged with the court when their contents become relevant to an issue in any pending matter in the action.

CCP § 2034.300

Except as provided in Section 2034.310 and in Articles 4 (commencing with Section 2034.610) and 5 (commencing with Section 2034.710), on objection of any party who has made a complete and timely compliance with Section 2034.260 , the trial court shall exclude from evidence the expert opinion of any witness that is offered by any party who has unreasonably failed to do any of the following:

(a) List that witness as an expert under Section 2034.260 .

(b) Submit an expert witness declaration.

(c) Produce reports and writings of expert witnesses under Section 2034.270 .

(d) Make that expert available for a deposition under Article 3 (commencing with Section 2034.410).

CCP § 2034.310

A party may call as a witness at trial an expert not previously designated by that party if either of the following conditions is satisfied:

(a) That expert has been designated by another party and has thereafter been deposed under Article 3 (commencing with Section 2034.410).

(b) That expert is called as a witness to impeach the testimony of an expert witness offered by any other party at the trial. This impeachment may include testimony to the falsity or nonexistence of any

fact used as the foundation for any opinion by any other party's expert witness, but may not include testimony that contradicts the opinion.

CCP § 2034.410

On receipt of an expert witness list from a party, any other party may take the deposition of any person on the list. The procedures for taking oral and written depositions set forth in Chapters 9 (commencing with Section 2025.010), 10 (commencing with Section 2026.010), and 11 (commencing with Section 2028.010) apply to a deposition of a listed trial expert witness except as provided in this article.

CCP § 2034.415

An expert described in subdivision (b) of Section 2034.210 whose deposition is noticed pursuant to Section 2025.220 shall, no later than three business days before his or her deposition, produce any materials or category of materials, including any electronically stored information, called for by the deposition notice.

CCP § 2034.420

The deposition of any expert described in subdivision (b) of Section 2034.210 shall be taken at a place that is within 75 miles of the courthouse where the action is pending. On motion for a protective order by the party designating an expert witness, and on a showing of exceptional hardship, the court may order that the deposition be taken at a more distant place from the courthouse.

CCP § 2034.430

(a) Except as provided in subdivision (f), this section applies to an expert witness, other than a party or an employee of a party, who is any of the following:

(1) An expert described in subdivision (b) of Section 2034.210 .

(2) A treating physician and surgeon or other treating health care practitioner who is to be asked during the deposition to express opinion testimony, including opinion or factual testimony regarding the past or present diagnosis or prognosis made by the practitioner or the reasons for a particular treatment decision made by the practitioner, but not including testimony requiring only the reading of words and symbols contained in the relevant medical record or, if those words and symbols are not legible to the deponent, the approximation by the deponent of what those words or symbols are.

(3) An architect, professional engineer, or licensed land surveyor who was involved with the original project design or survey for which that person is asked to express an opinion within the person's expertise and relevant to the action or proceeding.

(b) A party desiring to depose an expert witness described in subdivision (a) shall pay the expert's reasonable and customary hourly or daily fee for any time spent at the deposition from the time noticed in the deposition subpoena, or from the time of the arrival of the expert witness should that time be

later than the time noticed in the deposition subpoena, until the time the expert witness is dismissed from the deposition, regardless of whether the expert is actually deposed by any party attending the deposition.

(c) If any counsel representing the expert or a nonnoticing party is late to the deposition, the expert's reasonable and customary hourly or daily fee for the time period determined from the time noticed in the deposition subpoena until the counsel's late arrival, shall be paid by that tardy counsel.

(d) Notwithstanding subdivision (c), the hourly or daily fee charged to the tardy counsel shall not exceed the fee charged to the party who retained the expert, except where the expert donated services to a charitable or other nonprofit organization.

(e) A daily fee shall only be charged for a full day of attendance at a deposition or where the expert was required by the deposing party to be available for a full day and the expert necessarily had to forgo all business that the expert would otherwise have conducted that day but for the request that the expert be available all day for the scheduled deposition.

(f) In a worker's compensation case arising under Division 4 (commencing with Section 3201) or Division 4.5 (commencing with Section 6100) of the Labor Code , a party desiring to depose any expert on another party's expert witness list shall pay the fee under this section.

CCP § 2034.440

The party designating an expert is responsible for any fee charged by the expert for preparing for a deposition and for traveling to the place of the deposition, as well as for any travel expenses of the expert.

CCP § 2034.450

(a) The party taking the deposition of an expert witness shall either accompany the service of the deposition notice with a tender of the expert's fee based on the anticipated length of the deposition, or tender that fee at the commencement of the deposition.

(b) The expert's fee shall be delivered to the attorney for the party designating the expert.

(c) If the deposition of the expert takes longer than anticipated, the party giving notice of the deposition shall pay the balance of the expert's fee within five days of receipt of an itemized statement from the expert.

CCP § 2034.460

(a) The service of a proper deposition notice accompanied by the tender of the expert witness fee described in Section 2034.430 is effective to require the party employing or retaining the expert to produce the expert for the deposition.

(b) If the party noticing the deposition fails to tender the expert's fee under Section 2034.430 , the expert shall not be deposed at that time unless the parties stipulate otherwise.

CCP § 2034.470

(a) If a party desiring to take the deposition of an expert witness under this article deems that the hourly or daily fee of that expert for providing deposition testimony is unreasonable, that party may move for an order setting the compensation of that expert. Notice of this motion shall also be given to the expert.

(b) A motion under subdivision (a) shall be accompanied by a meet and confer declaration under Section 2016.040 . In any attempt at an informal resolution under Section 2016.040 , either the party or the expert shall provide the other with all of the following:

(1) Proof of the ordinary and customary fee actually charged and received by that expert for similar services provided outside the subject litigation.

(2) The total number of times the presently demanded fee has ever been charged and received by that expert.

(3) The frequency and regularity with which the presently demanded fee has been charged and received by that expert within the two-year period preceding the hearing on the motion.

(c) In addition to any other facts or evidence, the expert or the party designating the expert shall provide, and the court's determination as to the reasonableness of the fee shall be based on, proof of the ordinary and customary fee actually charged and received by that expert for similar services provided outside the subject litigation.

(d) In an action filed after January 1, 1994, the expert or the party designating the expert shall also provide, and the court's determination as to the reasonableness of the fee shall also be based on, both of the following:

(1) The total number of times the presently demanded fee has ever been charged and received by that expert.

(2) The frequency and regularity with which the presently demanded fee has been charged and received by that expert within the two-year period preceding the hearing on the motion.

(e) The court may also consider the ordinary and customary fees charged by similar experts for similar services within the relevant community and any other factors the court deems necessary or appropriate to make its determination.

(f) Upon a determination that the fee demanded by that expert is unreasonable, and based upon the evidence and factors considered, the court shall set the fee of the expert providing testimony.

(g) The court shall impose a monetary sanction under Chapter 7 (commencing with Section 2023.010) against any party, person, or attorney who unsuccessfully makes or opposes a motion to set the expert witness fee, unless it finds that the one subject to the sanction acted with substantial justification or that other circumstances make the imposition of the sanction unjust.

CCP § 2034.610

(a) On motion of any party who has engaged in a timely exchange of expert witness information, the court may grant leave to do either or both of the following:

(1) Augment that party's expert witness list and declaration by adding the name and address of any expert witness whom that party has subsequently retained.

(2) Amend that party's expert witness declaration with respect to the general substance of the testimony that an expert previously designated is expected to give.

(b) A motion under subdivision (a) shall be made at a sufficient time in advance of the time limit for the completion of discovery under Chapter 8 (commencing with Section 2024.010) to permit the deposition of any expert to whom the motion relates to be taken within that time limit. Under exceptional circumstances, the court may permit the motion to be made at a later time.

(c) The motion shall be accompanied by a meet and confer declaration under Section 2016.040 .

CCP § 2034.620

The court shall grant leave to augment or amend an expert witness list or declaration only if all of the following conditions are satisfied:

(a) The court has taken into account the extent to which the opposing party has relied on the list of expert witnesses.

(b) The court has determined that any party opposing the motion will not be prejudiced in maintaining that party's action or defense on the merits.

(c) The court has determined either of the following:

(1) The moving party would not in the exercise of reasonable diligence have determined to call that expert witness or have decided to offer the different or additional testimony of that expert witness.

(2) The moving party failed to determine to call that expert witness, or to offer the different or additional testimony of that expert witness as a result of mistake, inadvertence, surprise, or excusable neglect, and the moving party has done both of the following:

(A) Sought leave to augment or amend promptly after deciding to call the expert witness or to offer the different or additional testimony.

(B) Promptly thereafter served a copy of the proposed expert witness information concerning the expert or the testimony described in Section 2034.260 on all other parties who have appeared in the action.

(d) Leave to augment or amend is conditioned on the moving party making the expert available immediately for a deposition under Article 3 (commencing with Section 2034.410), and on any other

terms as may be just, including, but not limited to, leave to any party opposing the motion to designate additional expert witnesses or to elicit additional opinions from those previously designated, a continuance of the trial for a reasonable period of time, and the awarding of costs and litigation expenses to any party opposing the motion.

CCP § 2034.630

The court shall impose a monetary sanction under Chapter 7 (commencing with Section 2023.010) against any party, person, or attorney who unsuccessfully makes or opposes a motion to augment or amend expert witness information, unless it finds that the one subject to the sanction acted with substantial justification or that other circumstances make the imposition of the sanction unjust.

CCP § 2034.710

(a) On motion of any party who has failed to submit expert witness information on the date specified in a demand for that exchange, the court may grant leave to submit that information on a later date.

(b) A motion under subdivision (a) shall be made a sufficient time in advance of the time limit for the completion of discovery under Chapter 8 (commencing with Section 2024.010) to permit the deposition of any expert to whom the motion relates to be taken within that time limit. Under exceptional circumstances, the court may permit the motion to be made at a later time.

(c) The motion shall be accompanied by a meet and confer declaration under Section 2016.040 .

CCP § 2034.720

The court shall grant leave to submit tardy expert witness information only if all of the following conditions are satisfied:

(a) The court has taken into account the extent to which the opposing party has relied on the absence of a list of expert witnesses.

(b) The court has determined that any party opposing the motion will not be prejudiced in maintaining that party's action or defense on the merits.

(c) The court has determined that the moving party did all of the following:

(1) Failed to submit the information as the result of mistake, inadvertence, surprise, or excusable neglect.

(2) Sought leave to submit the information promptly after learning of the mistake, inadvertence, surprise, or excusable neglect.

(3) Promptly thereafter served a copy of the proposed expert witness information described in Section 2034.260 on all other parties who have appeared in the action.

(d) The order is conditioned on the moving party making the expert available immediately for a deposition under Article 3 (commencing with Section 2034.410), and on any other terms as may be just, including, but not limited to, leave to any party opposing the motion to designate additional expert witnesses or to elicit additional opinions from those previously designated, a continuance of the trial for a reasonable period of time, and the awarding of costs and litigation expenses to any party opposing the motion.

CCP § 2034.730

The court shall impose a monetary sanction under Chapter 7 (commencing with Section 2023.010) against any party, person, or attorney who unsuccessfully makes or opposes a motion to submit tardy expert witness information, unless it finds that the one subject to the sanction acted with substantial justification or that other circumstances make the imposition of the sanction unjust.

EVID § 720

(a) A person is qualified to testify as an expert if he has special knowledge, skill, experience, training, or education sufficient to qualify him as an expert on the subject to which his testimony relates. Against the objection of a party, such special knowledge, skill, experience, training, or education must be shown before the witness may testify as an expert.

(b) A witness' special knowledge, skill, experience, training, or education may be shown by any otherwise admissible evidence, including his own testimony.

EVID § 721

(a) Subject to subdivision (b), a witness testifying as an expert may be cross-examined to the same extent as any other witness and, in addition, may be fully cross-examined as to (1) his or her qualifications, (2) the subject to which his or her expert testimony relates, and (3) the matter upon which his or her opinion is based and the reasons for his or her opinion.

(b) If a witness testifying as an expert testifies in the form of an opinion, he or she may not be cross-examined in regard to the content or tenor of any scientific, technical, or professional text, treatise, journal, or similar publication unless any of the following occurs:

(1) The witness referred to, considered, or relied upon such publication in arriving at or forming his or her opinion.

(2) The publication has been admitted in evidence.

(3) The publication has been established as a reliable authority by the testimony or admission of the witness or by other expert testimony or by judicial notice.

If admitted, relevant portions of the publication may be read into evidence but may not be received as exhibits.

EVID § 722

(a) The fact of the appointment of an expert witness by the court may be revealed to the trier of fact.

(b) The compensation and expenses paid or to be paid to an expert witness by the party calling him is a proper subject of inquiry by any adverse party as relevant to the credibility of the witness and the weight of his testimony.

EVID § 723

The court may, at any time before or during the trial of an action, limit the number of expert witnesses to be called by any party.

EVID § 730

When it appears to the court, at any time before or during the trial of an action, that expert evidence is or may be required by the court or by any party to the action, the court on its own motion or on motion of any party may appoint one or more experts to investigate, to render a report as may be ordered by the court, and to testify as an expert at the trial of the action relative to the fact or matter as to which the expert evidence is or may be required. The court may fix the compensation for these services, if any, rendered by any person appointed under this section, in addition to any service as a witness, at the amount as seems reasonable to the court.

Nothing in this section shall be construed to permit a person to perform any act for which a license is required unless the person holds the appropriate license to lawfully perform that act.

EVID § 731

(a)(1) In all criminal actions and juvenile court proceedings, the compensation fixed under Section 730 shall be a charge against the county in which the action or proceeding is pending and shall be paid out of the treasury of that county on order of the court.

(2) Notwithstanding paragraph (1), if the expert is appointed for the court's needs, the compensation shall be a charge against the court.

(b) In any county in which the superior court so provides, the compensation fixed under Section 730 for medical experts appointed for the court's needs in civil actions shall be a charge against the court. In any county in which the board of supervisors so provides, the compensation fixed under Section 730 for medical experts appointed in civil actions, for purposes other than the court's needs, shall be a charge against and paid out of the treasury of that county on order of the court.

(c) Except as otherwise provided in this section, in all civil actions, the compensation fixed under Section 730 shall, in the first instance, be apportioned and charged to the several parties in a proportion as the court may determine and may thereafter be taxed and allowed in like manner as other costs.

EVID § 732

Any expert appointed by the court under Section 730 may be called and examined by the court or by any party to the action. When such witness is called and examined by the court, the parties have the same right as is expressed in Section 775 to cross-examine the witness and to object to the questions asked and the evidence adduced.

EVID § 733

Nothing contained in this article shall be deemed or construed to prevent any party to any action from producing other expert evidence on the same fact or matter mentioned in Section 730 ; but, where other expert witnesses are called by a party to the action, their fees shall be paid by the party calling them and only ordinary witness fees shall be taxed as costs in the action.

EVID § 800

If a witness is not testifying as an expert, his testimony in the form of an opinion is limited to such an opinion as is permitted by law, including but not limited to an opinion that is:

(a) Rationally based on the perception of the witness; and

(b) Helpful to a clear understanding of his testimony.

EVID § 801

If a witness is testifying as an expert, his testimony in the form of an opinion is limited to such an opinion as is:

(a) Related to a subject that is sufficiently beyond common experience that the opinion of an expert would assist the trier of fact; and

(b) Based on matter (including his special knowledge, skill, experience, training, and education) perceived by or personally known to the witness or made known to him at or before the hearing, whether or not admissible, that is of a type that reasonably may be relied upon by an expert in forming an opinion upon the subject to which his testimony relates, unless an expert is precluded by law from using such matter as a basis for his opinion

EVID § 802

A witness testifying in the form of an opinion may state on direct examination the reasons for his opinion and the matter (including, in the case of an expert, his special knowledge, skill, experience, training, and education) upon which it is based, unless he is precluded by law from using such reasons or matter as a basis for his opinion. The court in its discretion may require that a witness before testifying in the form of an opinion be first examined concerning the matter upon which his opinion is based.

EVID § 803

The court may, and upon objection shall, exclude testimony in the form of an opinion that is based in whole or in significant part on matter that is not a proper basis for such an opinion. In such case, the witness may, if there remains a proper basis for his opinion, then state his opinion after excluding from consideration the matter determined to be improper.

EVID § 804

(a) If a witness testifying as an expert testifies that his opinion is based in whole or in part upon the opinion or statement of another person, such other person may be called and examined by any adverse party as if under cross-examination concerning the opinion or statement.

(b) This section is not applicable if the person upon whose opinion or statement the expert witness has relied is (1) a party, (2) a person identified with a party within the meaning of subdivision (d) of Section 776 , or (3) a witness who has testified in the action concerning the subject matter of the opinion or statement upon which the expert witness has relied.

(c) Nothing in this section makes admissible an expert opinion that is inadmissible because it is based in whole or in part on the opinion or statement of another person.

(d) An expert opinion otherwise admissible is not made inadmissible by this section because it is based on the opinion or statement of a person who is unavailable for examination pursuant to this section.

EVID § 805

Testimony in the form of an opinion that is otherwise admissible is not objectionable because it embraces the ultimate issue to be decided by the trier of fact.

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DAUBERT /SARGON, FOUNDATION

Olive v. Gen. Nutrition Centers, Inc., 30 Cal. App. 5th 804 (2018). Trial judge properly excluded revenue expectations because comparisons [in CC 3344 (action re unauthorized use of P's likeness)] was to people far more famous than the party at issue here, and because revenue from one photo shoot was not comparable to more comprehensive celebrity deals. Reliance on out of context witness statement diminished reliability of opinions; and expert did not account for various other factors such as macroeconomic effects and so opinion was unduly speculative. RE: second expert: His opinion too was inadmissible because he relied on first expert opinion: generally that's ok as long as the relied-on opinion is the sort of material relied on by experts in the field, but here the first opinion was speculative, so second opinion fails as well.

Wendell v. GlaxoSmithKline LLC, 858 F.3d 1227, 1233 (9th Cir. 2017). Question of reliability. *Daubert*. Here, close question but trial court reversed for excluding expert. Didn't put enough emphasis on fact that experts were highly qualified, and while there could be criticism of some of their bases, trial court should have evaluated bases more generally, together. (Does not look like the use of abuse of discretion review?). Trial judge put too much weight on facts that (i) opinions developed just for this litigation and (ii) had not been published. Peer review is not essential, and standards for peer view are higher than the standards for admissions in court. Animal and epidemiological studies not essential. True, case studies are alone not enough, but they can contribute to the bases of expert opinion. Citing *Daubert II*, 43 F.3d at 1314, not knowing exactly how the causation works is not fatal, if there is compelling evidence that the agent caused to harm 'somehow" and expert need not exclude all other causes for opinion on causation to be admissible (so, chance of idiopathic disease is not fatal). Only 'junk science" is meant to be excluded under FRCP 702.

Taylor v. Trimble, 13 Cal. App. 5th 934, 945 n.15 (2017). An expert opinion that does not contain "a reasoned explanation illuminating why the facts have convinced the expert" need not be relied on.

David v. Hernandez, 13 Cal. App. 5th 692 (2017). Expert opinion properly excluded when the foundational facts were not established (here that party used marijuana within certain period). Expert speculation.

Esparza v. Safeway, Inc., 36 Cal. App. 5th 42 (2019). Expert decl. properly struck. Qu: whether there a way to "measure the value of the statutory guarantee taken from the class members." He "neither articulated a methodology for quantifying the money lost by the class members nor attempted to apply one to quantify it."

Peralta v. Vons Companies, Inc., 24 Cal. App. 5th 1030 (2018). Expert that conjectured that P's fall might have been caused to slippery surface not admissible- is speculation. Would be slippery if there was grease and oil- but no evidence that there was grease & oil

Willhide-Michiulis v. Mammoth Mountain Ski Area, LLC, 25 Cal. App. 5th 344 (2018). Expert declaration properly excluded: – did not inform court of customary practices of esoteric facts about snowmobiling. Didn't outline the industry standards, just repeated facts and concluded risk of injury was increased as a result: these conclusory materials not proper expert opinion.

Prop. California SCJLW One Corp. v. Leamy, 25 Cal. App. 5th 1155 (2018). Sargon applies to expert declarations submitted for summary judgment motions. Here, expert opines that case was over-litigated by lawyers. Ok to exclude opinion based on inadmissible materials (?) and failure to consider key documents; furthermore expert had opinion that very high invoices show malpractice, which is an opinion on the ultimate legal issue, which is not permissible.

PROPERTY VALUE

Cummings v. Dessel, 13 Cal. App. 5th 589 (2017). Owner competent to testify as to value of property.

PROCEDURE, DISCLOSURE

People v. Reardon, 26 Cal. App. 5th 727 (2018). Expert testimony admissible even if trial judge thinks it 'invades province of the jury' and is re 'ultimate issue'.

Belfiore-Braman v. Rotenberg, 25 Cal. App. 5th 234 (2018). Treating doctor here is expert, so is subject to disclosure requirements, and becomes retained expert when counsel gives him more information and then asks for opinion based on that added information. Here expert has no basis to determine causation, did not review records, didn't know amount of force needed to cause damages as posited by P. Also cumulative to other expert testimony.

Pina v. Cty. of Los Angeles, 38 Cal. App. 5th 531 (2019). Ok to have non-disclosed expert impeach other side's expert but here the impeaching witness went beyond that and offered opinions contradicting other side's expert opinion. This is reversible error here. What counts as permissible 'impeachment' is "strictly" construed to prevent the admission of contrary opinion, and it must be focused on contradicting a foundational fact. That does not allow impeacher to opine that the other expert misapplied or misunderstood relevant body of expert knowledge. Testifying that other expert opinion is not supported by the evidence is not "impeachment;" it is rather an impermissible contrary opinion. Opinion that no further surgery is needed is a contrary opinion. On the other hand, stating that MRI result did not show nerve compression, as other expert assumed it did, *was* permissible impeachment. [Note that the statement that MRI doesn't show compression is something *only an expert could say*--it's a form of opinion, but it goes directly to, and in this context it seems to be, a foundational 'fact'.] If the issue had been trying to respond to late-disclosed evidence, the party had plenty of time to ask to reopen expert discovery and to add an expert, but did not do so.

Du-All Safety, LLC v. Superior Court, 34 Cal. App. 5th 485 (2019). Trial court reversed for not allowing supplemental expert list when all statutory requirements complied with (citing text ¶ 8:1686): "The leading practice treatise puts it similarly: "Supplemental expert witness lists:

Sometimes, the exchange reveals that one party plans to call experts on subjects the opposing party assumed would not require expert testimony. In such cases, the opposing party has the right to supplement its expert witness exchange by adding experts to cover subjects on which the other party indicates it plans to offer expert testimony, and on which the opposing party had not previously retained an expert to testify."

352

People v. Garcia, 28 Cal. App. 5th 961 (2018). Expert testimony on eyewitnesses identification properly excluded under §352 as waste of time where there was much other evidence corroborating the identification of the D

COSTS, 998, fees

Dep't of Forestry & Fire Prot. v. Howell, 18 Cal. App. 5th 154 (2017). Section 1717 does not apply because there's no underlying contract- the existence of a statute which makes debts collectible 'in the same manner' doesn't make a contract. Also: 1021.5 fees- never should have awarded, Basic rule: two issues: whether private enforcement was necessary and whether the financial burden of private enforcement warrants subsidizing the successful party's attorneys. Here "even though the attorney fees, expert fees, and other costs incurred by defendants here are substantial, so too was the potential liability defendants faced in the litigation." So no 1021.5 fees

Berkeley Cement, Inc. v. Regents of Univ. of California, 30 Cal. App. 5th 1133 (2019). Costs of expert depositions (of opposing party's experts) under CCP 1033.5(b)- not allowed: Mediation fees: Not expressly allowable, but may be awarded, as may be arbitration costs, even if mediation was not court ordered.

Doe v. Los Angeles Cty. Dep't of Children & Family Servs., 37 Cal. App. 5th 675 (2019). Recoverable: filing fees, service of process, expert witness fees per 998

Huerta v. Kava Holdings, Inc., 29 Cal. App. 5th 74 (2018) Trial ct.: Costs and expert fees awarded on FEHA case, per 998. Reversed. Because action was not frivolous, no costs are awardable in FEHA case against P, and this rule trumps 998. Follows *Arave,* 19 CA5th at 553. {See new Govt C. eff. 1/1/18}

Williams v. The Pep Boys Manny Moe & Jack of California, 27 Cal. App. 5th 225 (2018). Asbestos. Survival and wrongful death claims- 998 offer must be apportioned between the two (there are really 2 different sets of plaintiffs) , and since it did not, it was invalid. Award of expert fees per 998 reversed.

569 E. Cty. Boulevard LLC v. Backcountry Against the Dump, Inc., 6 Cal. App. 5th 426 (2016). Anti-SLAPP motion. Fee reduced by 80%, OK. Ct relied on expert and own knowledge of prevailing fees; associates could have done a lot of the work; and some work not re: the anti-SLAPP motion

Requests for Admission

Orange Cty. Water Dist. v. The Arnold Eng'g Co., 31 CA5th 96 (2018). Costs may be awarded for unreasonable refusal to admit. Court more likely to find 'reasonable' grounds to believe party would prevail on RFA topic when the issue centers on expert opinion evidence. But sometimes relying on expert opinion is not reasonable; case lists the various factors {which seems very close to admissibility factors}. Cites federal analogous cases. Reviews trial ct. determination for reasonableness under abuse of discretion standard. Fact that party lost at trial is not relevant: issue is pretrial reasonableness; since jury here could have believed the expert, relying on expert is not unreasonable.

Samsky v. State Farm Mut. Auto. Ins. Co., 37 Cal. App. 5th 517 (2019). Perhaps opinion on first impression. Obtaining costs of proof where other party denied RFAs. Burden re: exceptions (where costs not awarded- i.e. had reasonable ground to believe it would prevail) is on party seeking to avoid costs, not on party propounding RFAs. Usually, party seeking an exception has the burden to establish it. *Smith*, 87 CA3d 267 is not useful and is re former version of statute. Party seeking to show it had a good basis to refuse RFA fails to do so by relying only on hearsay statement it knows won't be admitted and it can't find the declarant. And refusing party also fails its burden when, while it shows there was expert opinion, it fails to show it *relied* on that opinion in denying RFAs. Also, party's reliance on the experts would have to have been reasonable, which here it likely was not because the opinions were likely incredible (this appears to be dicta).

JUDICIAL NOTICE

Brown v. Smith, 24 Cal. App. 5th 1135 (2018). Information on vaccination noticed. Scientific facts can be noticed: facts widely accepted by experts and specialists which can be verified by reference to encyclopedias, treatises, almanacs etc.

DEMONSTRATIVE EVIDENCE

People v. Caro, 7 Cal. 5th 463 (2019). Conditions under which animations can be used to illustrate expert opinion- accurately depict opinion, proper limiting instruction, and passes muster under § 352. Here, approved. See also, *People v. Hung Tran,* 50 Cal. App. 5th 171 (2020)

TRIAL

Padda v. Superior Court, 25 Cal. App. 5th 25 (2018). Trial ct. should have granted continuance when main expert fell ill

MISC

People v. Julian, 34 Cal. App. 5th 878 (2019). Child sex abuse accommodation syndrome (CSAAS). Inadmissible statistical evidence. Statistical evidence of false allegations- "known to CPS to be 1% -8%"- very rare testified by expert. CSAAS testimony only comes to rehabilitate child credibility when D suggests child conduct after asserted molestation shows no molestation happened (child accommodates), but can't come in to show molestation occurred. Here testimony invited jury to find that it was statistically likely child had been abused.

Post *Sanchez* Authorities
Sanchez, 63 Cal.4th 665 (2016)

I provide terse notes on examples from published California state case citations as of June 2022. I ignore (i) cases discussed above in the text of this Manual, and (ii) confrontation clause discussions.

1. First, recall a good guide to hearsay, from our Supreme Court

   "the out-of-court statement must be offered for some purpose independent of the truth of the matters it asserts. That means that the statement must be capable of serving its nonhearsay purpose regardless of whether the jury believes the matters asserted to be true."(See….e.g., 2 McCormick on Evidence (7th ed. 2013) The Hearsay Rule, § 249, p. 189, fn. 2 ["if in fact the statement must be true for the inference desired, then the ostensible nonhearsay use is invalid"].)

   People v. Hopson, 3 Cal. 5th 424, 432 (2017)

   And this:

   A statement is not hearsay when offered to show the statement is false.

   People v. Selivanov, 5 Cal. App. 5th 726, 775 (2016)

2. Scope

   [The] reasoning of *People v. Sanchez*, 374 P.3d 320, which held that case-specific out-of-court statements related to jury by expert constitute hearsay when the content of those statements are treated as true and accurate to support the expert's opinion, applies equally when statements are used, not to support, but to undermine an expert's opinion on cross-examination.

   People v. Malik, 16 Cal. App. 5th 587 (2017)

   Sanchez applies at preliminary hearing. *Menifee v. Superior Ct. of Santa Clara Cty*., 57 Cal. App. 5th 343, 363 (2020)

3. Retroactivity

   Sanchez created new rule of law, and applies prospectively only. *People v. Perez* (2020) 9 Cal.5th 1; *In re Ruedas,* 23 Cal. App. 5th 777 (2018); *In re Thomas*, 30 Cal. App. 5th 744, 749 (2018)

4. Types of cases outside of criminal law where *Sanchez* applies

It applies generally to civil cases. It applies to Sexually Violent Predator Act, conservatorship proceedings, commitment of mentally disordered offender and to public nuisance actions. *J.H. v. Superior Court,* 20 Cal. App. 5th 530, 533 (2018); applies to SVP, *People v. Yates*, 25 Cal. App. 5th 474, 476 (2018); *People v. Roa*, 11 Cal. App. 5th 428, 433 (2017); *People v. Superior Court (Couthren)* (2019) 41 Cal.App.5th 1001, 1020; *Bennett v. Superior Court* (2019) 39 Cal.App.5th 862, 884. Applies to conservatorship proceedings, *Conservatorship of S.A.*, 25 Cal. App. 5th 438, 448 (2018).

Walker v. Superior Ct. of City & Cty. of San Francisco, 51 Cal. App. 5th 682, 694 (2020) (applies to SVP probable cause determination but nevertheless "the petitioner is allowed, despite their hearsay nature, to present the contents of any reports that form the basis of the petition as evidence."). But see *In re Morse*, 59 Cal. App. 5th 607, 612 (2021) (*Sanchez* not applicable to SVPA (sexually violent predator) probable cause determination.

Does it apply to commitments of mentally disordered offenders? Not clear, see this depublished case: "*Sanchez* is not applicable to MDO proceedings" *People v. Presley*, 8 Cal. App. 5th 617 (2017), review denied and ordered not to be officially published (May 24, 2017)

Court *assumes* it applies to LPS Act (petitions under Lanterman-Petris-Short Act) for reappointment of public conservator). *Conservatorship of K.W.*, 13 Cal. App. 5th 1274 (2017)

5. What is 'case specific?'

"Officer Adams was permitted to testify to non-case-specific general background information about Terra Bella, its rivalry with Project Boys, its primary activities, and its pattern of criminal activity, even if it was based on hearsay sources like gang members and gang officers." *People v. Meraz*, 6 Cal. App. 5th 1162, 1175 (2016)

expert testimony about "the general attributes of the ... gang, such as the gang's culture, the importance placed on reputation and guns, ... the gang's rivals and claimed turf, the use of monikers and identifying symbols, and the like, [are] permissible as expert background testimony." (People v. Iraheta (2017) 14 Cal.App.5th 1228, 1247, 222 Cal.Rptr.3d 706; People v. Meraz (2017) 6 Cal.App.5th 1162, 1175, 212 Cal.Rptr.3d 81 [expert may provide general background testimony about gang's operations, primary activities and pattern of criminal activities].) *People v. Anthony,* 32 Cal. App. 5th 1102, 244 Cal. Rptr. 3d 499, 529 (2019), review filed (Apr. 10, 2019)

Detective's testimony regarding gang's predicate offenses, which did not involve defendant, constituted background information rather than case-specific facts and thus did not implicate hearsay concerns. *People v. Bermudez,* 45 Cal.App.5th 358 (2020).

People v. Steskal, 11 Cal. 5th 332 (2021). Report of out-of-court description of person's distorted thinking, presented as an accurate report, is hearsay, and caused *Sanchez* problem

Peo. v. Valencia, 11 C5th 818, July 1, 2021. Extensive *Sanchez*, *Veamatahua* discussion. Predicate crimes introduced to show gang activity are case specific and require admissible

evidence. They are not part of experts' general background knowledge. This is not case specific: knowledge from training, experience, information from others, lectures, --if what experts in the field would rely on. That is *the indicia of reliability*- it's the knowledge of experts in the field, reliable er their common agreement, and beyond the common knowledge of laypeople. Otherwise, data is case specific.

Strobel, Sept 21, 2021, mod. Oct. 21. pet rev filed Nov. 1 2021. *Sanchez* issue: Expert relied (in part) on another's (Dr. Longo's) tests, and expert recitation of Longo tests was case specific which should be excluded as hearsay. Cannot repeat another expert opinion and dress it up as one's own, nor as non-case case specific "background". The samples and testing here were case specific. It is possible that an expert opinion/report/writing, when actually relied on by a variety of other experts, can become general, and so not case specific, in which case it could be relayed to the fact finder [but not here].

6. Hearsay & business records

When a record is not made to facilitate business operations but, instead, is primarily created for later use at trial, it does not qualify as a business record."
(*Sanchez*, *supra*, 63 Cal.4th at p. 695, fn. 21, 204 Cal.Rptr.3d 102, 374 P.3d 320; see *Melendez-Diaz v. Massachusetts* (2009) 557 U.S. 305, 321, 129 S.Ct. 2527, 174 L.Ed.2d 314 [certain documents kept in regular course of business—like police reports generated by law enforcement officials—not subject to business or official records hearsay exceptions because "the regularly conducted business activity is the production of evidence for use at trial"].)

People v. McVey, 24 Cal. App. 5th 405, 415 (2018)

7. How Much Can Expert Recite

Appellant maintains that *Sanchez* does not preclude expert testimony based on medical records and police reports showing Miller was schizophrenic and had been aggressive in contacts with Florida police 20 years earlier because "an expert may still rely on hearsay in forming an opinion and may tell the jury he did so in general terms, with a hypothetical including case specific facts." What appellant proposes is not simply informing the jury "in general terms" what the expert relied on, however. Rather, by appellant's reasoning, the exception would swallow the rule by allowing an expert to rely on case-specific hearsay under the fiction that it is not offered for its truth—precisely what *Sanchez* prohibits.

People v. McVey, 24 Cal. App. 5th 405, 417 (2018) (expert seems to have been proposed to recite case-specific facts)

8. Where Foundation Is Eliminated, So Is the Opinion

The trial court also properly excluded the defense expert's testimony based on the documents, for without disclosure of the contents of the records, any opinion the expert might have offered would have been irrelevant.

People v. McVey, 24 Cal. App. 5th 405, 417 (2018)

9. In criminal cases, sometime impermissible admission of hearsay [i.e., contra *Sanchez*] is harmless error

People v. Vega-Robles, 9 Cal. App. 5th 382, 387 (2017); *People v. Perez*, 4 Cal. 5th 421, 457 (2018); *People v. Anthony*, 32 Cal. App. 5th 1102, 1126 (2019); *People v. Flint*, 22 Cal. App. 5th 983, 1002 (2018); *People v. Calhoun,* 38 Cal.App.5th 275, 319 (2019)

NOT HARMLESS: *People v. Lara*, 9 Cal. App. 5th 296, 302 (2017); *People v. Burroughs*, 6 Cal. App. 5th 378, 403 (SVP) (2016)

10. In civil cases, sometime impermissible admission of hearsay [i.e., contra *Sanchez*] is harmless error

People ex rel. Reisig v. Acuna, 9 Cal. App. 5th 1, 36 (2017) (nuisance case)

11. *Sanchez* error deemed waived or forfeited

People v. Espinoza, 23 Cal. App. 5th 317, 320 (2018); *David v. Hernandez*, 13 Cal. App. 5th 692, 704 (2017)

RESOURCES: EXPERTS, STATISTICS, SCIENCE & BAD SCIENCE

Evidence & experts

- M. Simons, CALIFORNIA EVIDENCE MANUAL Ch.4 (Experts)
- M. Simons, "Introducing Hearsay Through An Expert: Is the Backdoor Closing?," 20 ABTL REPORT 1 (Summer 2011)
- CEB, ACTION GUIDE: HANDLING EXPERT WITNESSES IN CALIFORNIA COURT
- Curtis Karnow, "Sargon and the Science of Reliable Experts," 22 ABTL REPORT 1 (Spring 2013), original at http://works.bepress.com/curtis_karnow/
- David L. Faigman & Edward J. Imwinkelried, "Wading into the Daubert Tide: Sargon Enterprises, Inc. v. University of Southern California," 64 HASTINGS L.J. 1665, 1691 (2013) (authors of the law review article relied on in *Sargon*)
- Jules Epstein, "Preferring the "Wise Man" to Science: The Failure of Courts and Non-Litigation Mechanisms to Demand Validity in Forensic Matching Testimony," 20 WIDENER L. REV. 81, 82 (2014) (criticizing use of unproven forensic techniques such as latent prints and handwriting analysis)

Reporting bias & related issues (peer reviews)

- Christie Aschwanden, "Science Isn't Broken: It's just a hell of a lot harder than we give it credit for," *FiveThirtyEightScience* (August 19, 2015), http://fivethirtyeight.com/features/science-isnt-broken/ (superb review of rationales behind retractions of papers, why p values can be misleading, why peer reviewed journals don't guarantee reliability, etc. Provides an interactive chart that illustrates how p values can be easily manipulated)
- Daniele Fanelli, "How Many Scientists Fabricate and Falsify Research? A Systematic Review and Meta-Analysis of Survey Data," http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0005738
- B. Goldacre, BAD SCIENCE (2008); see also his site, http://www.badscience.net
- Richard Smith, "Peer Review: a flawed process at the heart of science and journals," 99:4 *J.R. Soc.Med*. 171 (April 2006), available at http://jrs.sagepub.com/content/99/4/178.long
- http://retractionwatch.com/2014/06/30/how-often-do-economists-commit-misconduct/ [the site *retractionwatch.com* has a very useful listing of retracted papers]
- http://www.physics.ohio-state.edu/~wilkins/science-fraud.html
- http://michaelnielsen.org/blog/three-myths-about-scientific-peer-review/
- http://www.wsj.com/articles/hank-campbell-the-corruption-of-peer-review-is-harming-scientific-credibility-1405290747
- David L. Faigman, "Anecdotal Forensics, Phrenology, and Other Abject Lessons from the History of Science," 59 HASTINGS L.J. 979 (2008)
- S. Goldbeck-Wood, "Evidence on peer reviews-scientific quality or smokescreen?," http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1114539/ ("nationality bias, language bias, specialty bias, and perhaps even gender bias, as well as the recognised [sic] bias toward the publication of positive results")
- "The Houses of Deceits: Science, Forensic Science, and Evidence and Introduction to Forensic Evidence," 35 LAND & WATER L. REV. 397, 400-01 (2000)

- Richard Wilson, "Technology and Society: Ensuring Sound Science in the Courts" (Harvard: 2003 draft), http://users.physics.harvard.edu/~wilson/publications/ppaper871.html#N_2_
- Richard van Noorden, "The Trouble with Retractions," 478 NATURE 26 (October 6, 2011)
- Benedict Carey, "Science, Now Under Scrutiny Itself," THE NEW YORK TIMES http://nyti.ms/1Gom501 (June 15, 2015)
- Ben Goldacre, "Scientists Are Hoarding Data And It's Ruining Medical Research: Major flaws in two massive trials of deworming pills show the importance of sharing data — which most scientists don't do,"(Jul. 22, 2015), http://www.buzzfeed.com/bengoldacre/deworming-trials
- http://www.sciencemag.org/content/348/6239/1100.2.full (retractions of scientific papers)
- http://www.nature.com/news/2011/111005/pdf/478026a.pdf (noting high increase in retractions of scientific papers)
- Christine Schmucker, "Extent of Non-Publication in Cohorts of Studies Approved by Research Ethics Committees or Included in Trial Registries," http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114023 (questioning validity of systematic reviews because journal publications represent a biased selection of all studies conducted [dissemination bias])
- Fujian Song, et al., "Dissemination and publication of research findings: an updated review of related biases," *Health Technol. Assess*. (2010), available at http://www.researchgate.net/profile/Fujian_Song/publication/41561626_Dissemination_and_publication_of_research_findings_an_updated_review_of_related_biases/links/09e4150b49a57536fc000000.pdf ("Studies with significant or positive results were more likely to be published than those with non-significant or negative results …There was convincing evidence that outcome reporting bias exists and has an impact on the pooled summary in systematic reviews. … published studies tended to report a greater treatment effect than those from the grey literature. Exclusion of non-English language studies appeared to result in a high risk of bias in some areas")
- See generally, Curtis Karnow, "Cognitive Fallacies Reading List," for more references on biases and fallacies which interfere with people's logical and scientific reasoning http://works.bepress.com/curtis_karnow/11/

Metastudies & reproducible results:

- *Cochrane systematic review*: http://www.cochrane.org/cochrane-reviews; http://bmg.cochrane.org/addressing-reporting-biases (Cochrane furthers transparency in research and publication, and use of metastudies)
- Importance of meta studies: http://community.cochrane.org/about-us/evidence-based-health-care/webliography/books/sysrev
- http://www.alltrials.net/
- http://boingboing.net/2014/05/15/half-of-all-clinical-trials-ne.html
- Ben Goldacre, "Listen carefully, I shall say this only once," *The Guardian* (October 25, 2008), available at http://www.badscience.net/2008/10/listen-carefully-i-shall-say-this-only-once/#more-823 (problems with issuing multiple reports of what is, in fact one study; contrast results of the 'one' study with metastudy results)

Fake science papers:

- Kerry Grens, "Fake Paper Exposes Failed Peer Review," *The Scientist* (October 6, 2013), available at http://www.the-scientist.com/?articles.view/articleNo/37798/title/Fake-Paper-Exposes-Failed-Peer-Review/
- http://pdos.csail.mit.edu/scigen/ [create your own fake paper in seconds]
- http://www.nature.com/news/publishers-withdraw-more-than-120-gibberish-papers-1.14763 (120 gibberish papers withdrawn)
- http://scigendetection.imag.fr/main.php (possible detection of fake papers)
- "Publishers withdraw more than 120 gibberish papers: Conference proceedings removed from subscription databases after scientist reveals that they were computer generated," NATURE NEWS & COMMENT (June 23, 2015)
- http://www.michaeleisen.org/blog/?p=1439 (story of getting a fake paper accepted by prestigious journal)

Science

- Robert Ehrlich: NINE CRAZY IDEAS IN SCIENCE (2002), http://press.princeton.edu/chapters/i7022.pdf
- Richard Feynman, THE PLEASURE OF FINDINGS THINGS OUT (2005)
- Karl Popper, CONJECTURES AND REFUTATIONS: THE GROWTH OF SCIENTIFIC KNOWLEDGE (1963-2002)
- Adam Becker, WHAT IS REAL? 260 ff. (2019)
- Willard Van Orman Quine, "Two Dogmas of Empiricism," FROM A LOGICAL POINT OF VIEW (Harvard 1953), http://www.ditext.com/quine/quine.html
- Thomas Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS (1962)
- Michael Luca et al., THE POWER OF EXPERIMENTS: DECISION MAKING IN A DATE-DRIVEN WORLD (2020)
- Richard Dawkins, SCIENCE IN THE SOUL (2017)
- ALICE AND BOB MEET THE WALL OF FIRE (ed. Thomas Lin, 2018) (a superb collection of essays from *Quanta*, https://www.quantamagazine.org/ noting current developments)

Charts and graphs – the good, the bad, the ugly, and the beautiful

- http://www.edwardtufte.com/tufte/index. Professor Tufte also discusses and illustrates *useful* graphical representations of data and statistics in his classic articles and books such as:
    - "Visual and Statistical Thinking: Displays of Evidence of Making Decisions," https://www.sfu.ca/cmns/courses/2012/801/1-Readings/Tufte%20Visual%20and%20Statistical%20Thinking.pdf
    - VISUAL DISPLAY OF QUANTITATIVE INFORMATION (1983)
    - ENVISIONING INFORMATION (1990)
    - VISUAL EXPLANATIONS (1997)
    - BEAUTIFUL EVIDENCE (2006)
- https://visualisingadvocacy.org/blog/disinformation-visualization-how-lie-datavis
- http://flowingdata.com/
- Manuel Lima, VISUAL COMPLEXITY: MAPPING PATTERNS OF INFORMATION (2011) (a lovely collection of short essays and many illustrations of complex systems and massive data sets)
- Wonderful graphical representations of statistical evidence: http://www.gapminder.org/
- Randy Krum, COOL INFOGRAPHICS (2014)

Public science literacy (or absence of)

- "Major Gaps Between the Public, Scientists on Key Issues," *Pew Research* (July 2015) http://www.pewinternet.org/interactives/public-scientists-opinion-gap/ ("Despite broadly similar views about the overall place of science in America, there are striking differences between the views of the public and those of the scientific community connected to the American Association for the Advancement of Science (AAAS) on a host of science-related issues, from whether genetically modified foods are safe to eat to whether the world's growing population will be a major problem")
- "Public's Knowledge of Science and Technology," *Pew Research* (April 2013)
- Gallup 2005, http://www.gallup.com/poll/16915/three-four-americans-believe-paranormal.aspx
- Public Policy Polling (2013) http://boingboing.net/2013/04/15/12-million-americans-believe-l.html (ESP: 41%; Haunted houses: 37%; Ghosts: 32%; Telepathy: 31%; Astrology: 25%; Lizard people control politics: 4% (12,556,562); +7% who are *not sure if lizard people are involved* (?!))
- "Science and Technology: Public Attitudes and Understanding," National Science Board (2004, most are 2001 results), http://www.nsf.gov/statistics/seind04/c7/c7s2.htm#c7s2l5:
    - Two-thirds (in 2001) do not have a firm grasp of what is meant by the scientific process
    - At least a quarter of population believes in astrology
    - Europeans were more likely to say that astrology is scientific than to say the same about economics
    - Europeans (46%) Americans (32%) agree that "some numbers are particularly lucky for some people"
    - At least half of U.S. believes in the existence of extrasensory perception (ESP)
    - 30% agreed that "some of the unidentified flying objects that have been reported are really space vehicles from other civilizations."
- Eula Biss, ON IMMUNITY: AN INOCULATION (2014) (why educated middle class Americans irrationally fear immunizations)

Statistics

- David Freedman et al., STATISTICS (4th ed.2007); Kaye & Freedman, 'Reference Guide on Statistics', in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE (3d ed.2011) relied on by the Supreme Court in *Duran v. U.S. Bank Nat. Assn*., 59 Cal. 4th 1, 38, 43 (2014); see also earlier edition, D. Freeman, STATISTICS (3d ed. 1998). The 1061 page REFERENCE MANUAL, which is found at http://www.fjc.gov/public/pdf.nsf/lookup/SciMan3D01.pdf/$file/SciMan3D01.pdf, also includes:
    - "Reference Guide on Multiple Regression"
    - "Reference Guide on Survey Evidence"
- David Spiegelhalter, THE ART OF STATISTICS: HOW TO LEARN FROM DATA 279 (2021) (offred as an introduction, many of the book's chapters are difficult for a beginner, but this provides a first rate discussion of the issues, the ways in which statistics ae abused, and what to do about it)
- Christie Aschwanden, "Statisticians Found One Thing They Can Agree On: It's Time To Stop Misusing P-Values," (March 7, 2016), http://fivethirtyeight.com/features/statisticians-found-one-thing-they-can-agree-on-its-time-to-stop-misusing-p-values/ (good discussion of what p values don't mean); see also See, Christie Aschwanden, "Science Isn't Broken" under Reporting bias & related issues above
- Douglas Downing, et al., STATISTICS THE EASY WAY (1989)

- Larry Gonick, et al., THE CARTOON GUIDE TO STATISTICS (1993) (a fun and fast introduction)
- Darrell Huff, HOW TO LIE WITH STATISTICS (1954) (presumably required law school reading; one of the many books listed here warning of the dangers of bad statistics)
- Alex Reinhart, STATISTICS DONE WRONG: THE WOEFULLY COMPLETE GUIDE (2015)
- Sherry Seethaler, LIES, DAMNED LIES, AND STATISTICS (2009)
- Jordan Ellenberg, HOW NOT TO BE WRONG: THE POWER OF MATHEMATICAL THINKING (2015) (broad introduction to practical mathematical literacy, including materials on statistics)
- Edward Cheng, "Fighting Legal Innumeracy," 17 GREEN BAG 2D 271 (Spring 2014) (reasons and plea for better understanding of statistics in the legal profession)
- George Akerlof & Robert Schiller, PHISHING FOR PHOOLS: THE ECONOMICS OF MANIPULATION AND DECEPTION (2015) (an entirely accessible review by two Nobel Prize winners of ways in which numbers are used to fool the public, information asymmetry in the markets, and the role of regulation; not a detailed review of the misuse of statistics as such)
- C. Seife, PROOFINESS (2010) (subtitled, "The Dark Art of Mathematical Deception")
- G. Gigerenzer, RISK SAVVY (2014)
- C. Wheelan, NAKED STATISTICS (2013)
- Megan Higgs, "Do We Really Need the S-word?," AMERICAN SCIENTIST (Jan.-Feb. 2014), available at http://www.americanscientist.org/issues/pub/do-we-really-need-the-s-word/1 (noting problems misunderstanding 'significance' in connection with p values)
- Curtis Karnow, "Statistics In Law: Bad Inferences & Uncommon Sense" (2011), http://works.bepress.com/curtis_karnow/, reprinted in Curtis Karnow, LITIGATION IN PRACTICE (2017)
- Curtis Karnow, "Compression Algorithm: Big Data in Small Courtrooms," 25 ABTL Report 1 (Winter 2016), https://works.bepress.com/curtis_karnow/43/
- Gary Smith, STANDARD DEVIATIONS (2014)
- Timothy Urdan, STATISTICS IN PLAIN ENGLISH (3d ed. 2010)
- Ian Ayers, SUPER CRUNCHERS (statistics and other use of large numbers in a variety of disciplines, written for a general audience)
- John Phillips, Jr., HOW TO THINK ABOUT STATISTICS (1971)
- N.N. Taleb, THE BLACK SWAN: THE IMPACT OF THE HIGHLY IMPROBABLE (2010)
- Marcy M. Hallock, "The Numbers Game - The Use and Misuse of Statistics in Civil Rights Litigation," 23 Vill. L. Rev. 5 (1978)
- Regina Nuzzo, "Scientific method: statistical errors," *Nature,* February 12, 2014, http://www.nature.com/news/scientific-method-statistical-errors-1.14700 (weakness of just using p values)
- A.K. Dewdney, 200% OF NOTHING (1993) (subtitled "An Eye-Opening Tour Through the Twists and Turns of Math Abuse and Innumeracy")
- "Just Plain Data Analysis: Common Statistical Fallacies in Analyses of Social Indicator Data," also found here: http://lilt.ilstu.edu/jpda/interpreting/interpreting_the_numbers.htm
- See sample misleading statistics at http://www.econoclass.com/misleadingstats.html
- Statistical fallacies: http://lilt.ilstu.edu/jpda/interpreting/interpreting_the_numbers.htm
- Type I and type II errors in the context of the criminal justice system: http://intuitor.com/statistics/T1T2Errors.html
- D. Kaye et al., Reference Guide on Statistics, http://ftp.resource.org/courts.gov/fjc/sciam.0.stats.pdf
- "The Use -- and Misuse -- of Statistics: How and Why Numbers Are So Easily Manipulated" (April 2, 2008), located at Knowledge@Wharton

- Excellent series of videos on many subjects including probability and statistics: see kahnacademy.org
- Statistical evidence of forgery: http://en.wikipedia.org/wiki/Howland_will_forgery_trial

- *Walking through the Bayesian theorem:*
    - http://www.vjs.org/spam/bayesian-analysis.html
    - http://www.kilty.com/class8.htm
    - Peter Sedlmeier & Gerd Gigerenzer, "Teaching Bayesian Reasoning in Less Than Two Hours," 130 *Journal of Experimental Psychology: General* 380-400 (2001)
    - Shaon Bentsch Mcgrayne, THE THEORY THAT WOULD NOT DIE: HOW BAYES' RULE CRACKED THE ENIGMA CODE, HUNTED DOWN RUSSIAN SUBMARINES, & EMERGED TRIUMPHANT FROM THE CENTURIES OF CONTROVERSY (2011) (with this title, who can resist?)

A few cases on statistics

- Case in which the rejected statistical survey used the wrong population for sampling: *Citizens Financial Group, Inc. v. Citizens Nat. Bank of Evans City*, 383 F.3d 110, 120 (3d Cir. 2004)
- Case in which the trial court was reversed for having fallen into a statistical trap (a 'logical fallacy,' the appellate court called it): *Sylvia Darensburg v. Metropolitan Transportation Commission* (9th Cir., February 16, 2011, No. 09-15878)
- Court takes judicial notice of certain statistical facts: *Envtl. Law Found. v. Beech-Nut Nutrition Corp.,* 235 Cal. App. 4th 307, 325 n.7 (2015)
- Trial plan failures, including failure to present viable statistical plan, support denial of class certification: *Mies v. Sephora U.S.A., Inc.,* 234 Cal. App. 4th 967 (2015)
- "Statistical significance" discussed: *Lewis v. Ascension Par. Sch. Bd*., 806 F.3d 344, 362 n.24 (5th Cir. 2015); *Chen-Oster v. Goldman, Sachs & Co*., 114 F. Supp. 3d 110 & n.4 (S.D.N.Y. 2015)
- Problems with sample size: *Duran v. U.S. Bank Nat'l Assn*., 59 Cal. 4th 1, 33 (2014) ("small, skewed sample"); *LAOSD Asbestos Cases,* 44 Cal. App. 5th 475, 491 (2020) ("test results of raw talc based on miniscule sample sizes"); *People v. Parker*, 2 Cal. 5th 1184, 1213 n.12 (2017) (jury selection issues); *People v. Johnson*, 8 Cal. 5th 475, 508 (2019) (same); *McGrory v. Applied Signal Tech., Inc.*, 212 Cal. App. 4th 1510, 1536 (2013); *E.E.O.C. v. Freeman*, 778 F.3d 463, 469 & n.1 (4th Cir. 2015); *Freyd v. University of Oregon*, 990 F.3d 1211, 1239 (9th Cir. 2021) (Vandyke, J., concurring in part & disagreeing with majority that that a valid disagreement among expert is presented when one side's statistics are invalid (small sample size)); *Thompson v. Fresh Products, LLC,* 985 F.3d 509, 527 (6th Cir. 2021)
- Use of regression analysis: *E.g., In re Se. Milk Antitrust Litig.,* 739 F.3d 262, 285 (6th Cir.) *cert. denied sub nom. Dean Foods Co. v. Food Lion, LLC*, 135 S. Ct. 676 (2014); *Werdebaugh v. Blue Diamond Growers*, 2014 WL 2191901 (N.D. Cal. May 23, 2014) (proving damages under UCL, FAL, and CLRA); *Kleen Products LLC v. Int'l Paper*, 306 F.R.D. 585, 602 (N.D. Ill. 2015); *ATA Airlines, Inc. v. Federal Exp. Corp.,* 665 F.3d 882, 889 (7th Cir. 2011) (Posner, J.) (faulty regression analysis)
- The "prosecutor's fallacy," *People v. Cua*, 191 Cal.App.4th 582, 597 (2011)

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Statistics: On-line glossaries and basic introductions

http://www.stats.gla.ac.uk/steps/glossary/presenting_data.html#med
http://stats.oecd.org/glossary/
http://en.wikipedia.org/wiki/Glossary_of_probability_and_statistics
http://bobhall.tamu.edu/FiniteMath/Module8/Introduction.html
http://stattrek.com/Help/Glossary.aspx
http://statistics.berkeley.edu/~stark/SticiGui/Text/gloss.htm
http://www.statsoft.com/textbook/basic-statistics/
http://www.statpac.com/statistics-calculator/correlation-regression.htm

Calculators

http://easycalculation.com/statistics/statistics.php http://www.surveysystem.com/sscalc.htm
http://www.dimensionresearch.com/resources/calculators/conf_means.html
http://www.stat.tamu.edu/~jhardin/applets/
E.g. calculate p value:
http://www.ehow.com/how_5073193_calculate-p_values-t_tests.html

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A few notes on standard deviation:

Assume the SD for IQ (intelligence) is 15; then 2 SD = 30. So 95% (about 2 SD) people have an IQ between 70 (100 = mean, ± 15 x 2) and 130 (= 100 + 2 x 15)
If what we're measuring is less variable, say with a SD=5, then the 95% [or 2 SD range] would be 100 ± 10, i.e., 90-110

A few notes on the value of p:

High p is bad, low p is good.
P = 0.05 is generally borderline acceptable error, statistically significant for many uses.
P < 0.01 commonly considered statistically significant.
P ≤ 0.005 or p ≤ 0.001 means the findings are highly statistically significant.
The significance level of a statistical hypothesis test is a fixed probability of wrongly rejecting the null hypothesis,[167] if it is in fact true.
Often, the significance level is chosen to be 0.05 (or equivalently, 5%).

These phrases all these mean roughly the same thing:

The finding is significant at the .05 level.
The confidence level is 95 percent.
There is a 95 percent certainty that the result (testing the null) is not due to chance.

[167] The null hypothesis is the opposite of the claim being tested. I.e. if the hypothesis is that Drug X reduces cancer, then the null hypothesis is that Drug X does not reduce cancer.

There is a 1 in 20 chance of obtaining this result by chance.
The *p*-value is .05.

A classic error in understanding "margin of error":

Assume we have poll that ranks two candidates: Laurel comes in at 52%, and Hardy at 48%. We told there is a "margin of error" of ± 2%.
Does this mean that in fact the two candidates are too close to call? Because both candidates could be, with a margin of error at ± 2%, at 50%?
No. That intuition is misleading.
Here's how we interpret the results. Let's assume we have the classic two standard deviation results (that's where the 95% chance language below comes from):
Laurel has a 95% chance that the REAL number (in the population) is somewhere between 50-54%
Hardy has a 95% chance that the REAL number (in the population) is somewhere between 46-50%.
So: Laurel is very, very likely the winner in the real world/population.

A note on the bizarre Newcomb-Benford Law:

As we study randomness and seek to develop our intuitions, it is worth repeating that our sense of what is, and is not, random, is often at odds with reality.
One of the most bizarre examples of this is the Newcomb-Bedford law, which notes that when we look at the first significant figures of a number (i.e. '3' in 385 or '7' in 785,945) smaller numbers predominate over larger numbers in a wide variety of real world circumstances. For example, if we look at the leading number of bank accounts, stock prices, numbers on tax returns, the areas and population of countries, and the starting page numbers of papers from a bibliography, and many other numbers, we will see that the smaller the number, the more frequently it occurs. "1" appears almost 1/3 of the time, although we might think that, randomly, it would appear about 1/9 of the time. "1" appears most frequently, "2" next in frequency, and so on. In short, apparently random numbers may actually be evidence of artificiality. As a result, statistical studies of check amounts, numbers in tax returns, and other figures can detect artificial numbers-- that is, fraud.
See, e.g., http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0010541
http://www.lynceangroup.net/BenfordLynceanPresentation.pdf
The technique has been used to detect vote fraud. Peter Klimek, et al., "Statistical detection of systematic election irregularities," *Proc Natl Acad Sci U S A*. 109(41): 16469–16473 (2012), http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3478593/. Others have suggested Benford's law is not useful in this way, Joseph Deckert, et al., "Benford's Law and the Detection of Election Fraud," *Political Analysis* 19 (3):245-268 (2011), http://pan.oxfordjournals.org/content/19/3/245.abstract. *Compare*, e.g., Walter R. Mebane Jr., "Comment on "Benford's Law and the Detection of Election Fraud," *Political Analysis* (2011) 19 (3):269-272 (2011), http://pan.oxfordjournals.org/content/19/3/269.abstract (severe criticism of Deckert article)

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Deciphering notations and terms:

Confidence level of 95% corresponds to a significance level (p) of 5%; a confidence level of 99% corresponds to a significance level of 1%.

± = plus or minus

Σ = 'sum' and indicates one is to add up (or sum) the indicated numbers, as follows:

$$\sum_{i=1}^{n}$$

This indicates that one "sums" (or adds up) the numbers starting with 1 (because i indicates the number to start with, which here =1) and go the last number, which is n.

So *if we're told n=3*, then this:

$$\sum_{i=1}^{N}$$

is the equivalent to: 1+2+3, i.e., 6.

μ = population mean (*pronounced "mu"*)
which is in turn calculated with this formula:
$(\Sigma x_i) / n$
This says: the sum of (Σ) all the numbers x_1 to x_2, x_3 through the end, then divide by the number of x's ('n'). So if all our x's (sample data) are 1, 4, 7, and 8, then we sum them (= 20) and we divide by the number of samples we have, 4, so the result is: μ=5.

σ = Population standard deviation = $\text{sqrt} [\Sigma (X_i - \mu)^2 / N]$

σ squared (or σ^2) = variance

$\bar{x}$ = sample mean
which is calculated this way:
$(\Sigma x_i) / n$

P = probability
P(A) = probability of event A
P(A | B) = probability of A given B has occurred
∩ = intersection = "and"
U = union = "or"
P(A or B) = P(A U B) = probability of A or B occurring
P(A and B) = P(A ∩ B) = probability of A and B both occurring

For further explanations of symbols and terms, see e.g.
*www.stat.tamu.edu/~julie/302/handouts/**symbols**.doc*

Sargon and the Science of Reliable Experts
22 *ABTL Report* 1 (Spring 2013) (footnotes renumbered here)

By
Curtis E.A. Karnow[168]

Eppur si muove[169]

Some have suggested a sea change in rules governing the admission of expert testimony as a result of the Supreme Court's decision in *Sargon Enterprises, Inc. v. University of Southern California*, 55 Cal.4th 747 (2012). The suggestion is likely animated by the contrast of *Sargon*'s approving invocation of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)[170] with the Court's earlier polite refusal to adopt *Daubert* in *People v. Leahy*, 8 Cal.4th 587 (1994).[171] There is a visceral thing here, too: it has been commonly accepted deep in lawyers' bones that (as a result of *Daubert*'s impact in federal courts) state courts were more open than federal courts to certain expert testimony.[172] So, with *Sargon*'s emphatic instruction to trial courts that they act as "gatekeepers" (invoking *Daubert*'s iconic term), it has been supposed that state courts will now tend more to restrict expert testimony. Perhaps; I couldn't possibly say. But it is worth stepping back, just a bit, to tease out what *Sargon* did and did not address.

First a short refresher on *Sargon*. Our Supreme Court reversed the Court of Appeal, in effect affirming the wise trial judge who had tossed out speculative expert testimony on lost profits. Plaintiff had asserted that but for the defendant University's failure to conduct a clinical study of a new dental implant, plaintiff would have realized zillions (well, up to over a billion) in profits. The expert had selected putatively comparable firms to generate the profit ratios, without doing much to explain the selection criteria.

Much of the language in *Sargon* suggests the ordinary application of extant California law. For example, the Court remarked that experts may not rely on speculative bases; and they cannot rely on facts not in evidence. This does not shock us. The Court repeatedly relied on familiar statutes, such as Evidence Code §§ 801 and 802, including in a clause that invokes the 'gatekeeper' role for trial judges. 55 Cal.4th at 770 & 771.[173] And *Sargon*'s adverse reaction to the gulf that separated the expert's conclusion and his bases was a pretty routine application of state law: trial judges have always been required to decide

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[168] This article is designed only to open issues for discussion, and provides no indication on how I or any other judge would rule in a specific case. This article appeared in a different form at 22 ABTL REPORT 1 (Spring 2013).
[169] "Still, it moves," Galileo (ever the experimental scientist) reportedly said of the Earth's orbit of the Sun, even as he accepted terms from the Inquisition.
[170] *E.g.*, *Sargon*, 55 Cal.4th at 772.
[171] The federal courts had shifted away (i.e. in *Daubert*) from the 'general acceptance' test after a revision to Federal Rules of Evidence 702 in 1975, because neither the text of the rule nor "the Advisory Committee Notes to Congress, nor the Legislators during floor debates made any mention of *Frye* or the 'general acceptance' test." Leslie Morsek et. al., "Get on Board for the Ride of Your Life! The Ups, the Downs, the Twists, and the Turns of the Applicability of the 'Gatekeeper' Function to Scientific and Non-Scientific Expert Evidence: Kumho's Expansion of Daubert," 34 AKRON L. REV. 689, 700-03 (2001)(notes omitted). *See also, People v. Venegas*, 18 Cal.4th 47, 76 n.30 (1998).
[172] E.g., W. Schwarzer, et al., FEDERAL CIVIL PROCEDURE BEFORE TRIAL, Ch. 1-D ¶ 1:1060 (2012).
[173] *See also* 55 Cal.4th at 769 ("Under California law, trial courts have a substantial "gatekeeping" responsibility").

whether or not the expert's bases actually support his opinion. *Lockheed Litigation Cases,* 115 Cal.App.4th 558, 563 (2004) (cited with approval in *Sargon*).

But the Court goes out of its way in a footnote to alert us that on one specific matter, California law has not shifted. This is noteworthy for two complementary reasons. First, of course, it confirms the status quo at least in that area. But secondly, it suggests the Court may be aware that its embrace of *Daubert* may otherwise be seen as a shift. Here's the note:

> In *People v. Leahy* (1994) 8 Cal.4th 587, 604 …, this court held that the "general acceptance" test for admissibility of expert testimony based on new scientific techniques (see *People v. Kelly* (1976) 17 Cal.3d 24 …) still applies in California courts despite the United States Supreme Court's rejection, in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579 …, of a similar test in federal courts. Nothing we say in this case affects our holding in *Leahy* regarding new scientific techniques.

Sargon, 55 Cal.4th at 772 n.6 (citations abbreviated).

The distinction is between new scientific techniques and other expert testimony. The *Kelly* test had been developed deliberately to make courts laggard in the adoption of new science; courts were not to be the test-bed for new techniques. Not unless a technique was "generally accepted" would the courts even consider its use at trial. But much expert testimony—such as that in *Sargon*—never involves such new techniques, and so is never subject to the *Kelly* test. *People v Bui*, 86 Cal.App.4th 1187, 1195 (2001).

So if *Sargon* leaves in peace the law on novel scientific techniques, what might it have in mind for the rest of expert testimony? Maybe nothing but a reminder that judges must always keep speculation away from the jury; and that is one reasonable reading of the case. After all, the strict holding of the case can likely be explained just with that reasoning.

But it is also possible that *Sargon* has more to say; perhaps also a new angle on what speculation entails.

Let's try a hypo. An expert has this opinion: defendant Danny's car could have stopped before it hit the now injured Peter plaintiff. Two branches feed this opinion: facts and theory. The facts are these: Danny saw Peter ten seconds before impact; it takes a second to process and another second to hit the brakes; given Danny's speed and the braking power of the brakes, the car would have come to a complete stop in five seconds—which is enough to avoid the accident. The theories are these: force = mass * acceleration; human action is a function of nerve impulses, and they travel at a certain speed; brakes work in a certain way; and so on. The opinion is obviously unreliable if either the facts or theories are unsupported.

Setting aside the facts, let us turn to the theories:[174] How do we know if these are reliable? Does force really equal mass times acceleration? Is human action the product of nerve impulses or demonic inspiration? In state courts, we have typically looked to see if the theories (e.g., thermodynamics and neurology) were 'generally accepted' in the relevant scientific community. The impetus under *Kelly* was

[174] The distinction I use between case-specific 'fact' and general 'theory' is probably equivalent to the distinction between the "minor premise" and the "major premise" in a key article relied on in *Sargon*, Edward J. Imwinkelried & David L. Faigman, "Evidence Code Section 802: The Neglected Key to Rationalizing the California Law of Expert Testimony," 42 LOY. L.A. L. REV. 427, 434 (2009) (hereinafter IMWINKELRIED).

to look to the expert community and leave the matter there. *Leahy*, 8 Cal.4th at 602-03. But what we had forgotten—perhaps until *Sargon*—was that the rule was meant to *block* putative 'science' as to which there was no consensus; it is something else entirely to *accept* in the courtroom a theory just because there is some consensus.

Justice Breyer, in a case cited with approval by *Sargon*, put it this way:

> It might not be surprising in a particular case, for example, that a claim made by a scientific witness has never been the subject of peer review, for the particular application at issue may never previously have interested any scientist. Nor, on the other hand, does the presence of *Daubert's* general acceptance factor help show that an expert's testimony is reliable where the discipline itself lacks reliability, as, for example, do theories grounded in any so-called generally accepted principles of astrology or necromancy.[175]

Specialization, and so the contrivance of expertise, is endemic. It is not therefore evil: we really do know more than we did, there are more areas of legitimate expertise, and it is increasingly difficult for any person to master the entirety of a traditional area (such as 'medicine' or 'law' or 'physics'). But we are now sufficiently numerous and balkanized that any theory will collect adherents: and they are free to conduct their discipline as they wish, complete with conferences, magazines, web pages, and on. Doctrine 'generally accepted' by one of these cults will not just for that reason be admissible.

But neither can we wait for a methodology to be *universally* accepted; it won't happen, universal consensus is impossible to prove, and anyway the rules of evidence contemplate conflicting expert views.

So what sort of consensus is enough?

Sargon's emphasis on reliability is helpful. Previously, some state courts might have stopped their review of expertise after what I think of as a *horizontal* look: whether the methods are generally accepted, which often meant the identification of peers of the proffered expert. *Sargon*, like *Kumho Tire*, backs us up one level, and may invite a *vertical* bird's eye review of the methodology.

How then to describe that vertical perch used to evaluate whether a discipline, methodology or practice is reliable, whether or not embraced by experts in the pertinent discipline? In other words, how do we distinguish astronomy from astrology? *Sargon*'s invocation of *Daubert* gives the clue: The discipline and materials relied on must be *scientific*. Astronomy is a science; astrology isn't. *Daubert* assumes "that trial judges would undertake their own assessment drawing upon the features of 'good science' and 'the scientific method.'"[176] One of the important *Daubert* factors was acceptance in the relevant community, to be sure, but it was the relevant *scientific* community.

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[175] *Kumho Tire Co., Ltd. v. Carmichael,* 526 U.S. 137, 151 (1999).

[176] Gary Edmond & David Mercer, "Conjectures and Exhumations: Citations of History, Philosophy and Sociology of Science in US Federal Courts," 14 LAW & LITERATURE 309, 310 (2002). *See also* "Admitting Doubt: A New Standard for Scientific Evidence," 123 HARV. L. REV. 2021, 2023 (2010) (objecting that "*Daubert* tasks judges with separating good science from bad").

I doubt *Daubert* could be more clear on what it thought of as the scientific approach, for it expressly relies on Karl Popper's work in defining a scientific proposition as one which can be refuted.[177] We must be able to at least conceive of empirical tests which can disprove or falsify a position; else the proposition is not science.

We tell ourselves stories all the time, and have faith concerning all sorts of phenomena. We have ghosts, gods and atoms, Illuminati conspiracies, price-fixing conspiracies, beliefs on why blood congeals and wings fly, and how light behaves in space. All of these are conjectures about things we cannot see, all helpful narratives with which we sooth ourselves. Popper's point is that some of these conjectures are testable; and if we succeed in falsifying the theory, "we see very clearly that there was a reality—something with which it could clash."[178] Only with scientific propositions do we have a lucid notion of what it means to be wrong; only scientific propositions deal with the relevant notion of reality. It is in this light that we can understand the elements traditionally associated with *Daubert*—they evoke this sense of science:

While there is no definitive "checklist or test," the following factors may be relevant in evaluating the reliability of expert opinion testimony:

- whether the methodology used can be (and has been) tested;
- whether the methodology has been subjected to peer review;
- whether there is a known potential rate of error;
- whether there are standards controlling the technique used;
- whether a known technique is generally accepted in the relevant scientific or technical community.[179]

Scientific theories try to explain the visible world through the use of an invisible one,[180] whether it be by the use of the four humours, luminiferous aether**,** or quantum mechanics. The doctrine of luminiferous aether, for example, despite its ancient (and pleasing) sound, *was* scientific: it was not only testable, but tested and disproved in 1887.[181] Scientific theories are not necessarily right, but experts who tell you they are right can probably tell you how the theory could be disproved.

So, is *Sargon*'s emphasis on *Daubert* a shift in the law? Well, it calls out the need for scientific justification of the disciplines subject of expert testimony, and I like to think even state judges have

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[177] *Daubert*, 509 U.S. at 593. *See generally*, Karl R. Popper, CONJECTURES AND REFUTATIONS: THE GROWTH OF SCIENTIFIC KNOWLEDGE (1963)(hereinafter POPPER).

[178] POPPER, *supra* note 10 at 116. Theories, which start with stories and myths, *id*. at 50, can never be confirmed because tests are never exhaustive, *id*. at 105, but they can be disproved, *id*. at 114-15. This makes them scientific statements. *Ibid*. But Popper did believe in the notion of growth, or closer approximation to the truth over time, even if one can never know that a given theory is correct. This much is evident from the name of one of his essays, "Truth, Rationality, And The Growth Of Scientific Knowledge," POPPER, *supra* note 10 at 215 *et seq*.; *see also id*. at ix (Preface to Second Edition).

[179] William Wegner, et al., CALIFORNIA PRACTICE GUIDE: FEDERAL CIVIL TRIALS & EVIDENCE Ch. 8F-C. Whenever we are faced with a series of factors, results from different cases are likely to be a matter of degree, i.e., methods may be more or less 'scientific' in this *Daubert* sense. Scientific validity generally is probably a matter of degree. Frederick Schauer, "Can Bad Science Be Good Evidence? Neuroscience, Lie Detection, and Beyond," 95 CORNELL L. REV. 1191, 1207 (2010).

[180] POPPER, *supra* note 10 at 89.

[181] This was the Michelson-Morley experiment which ultimately led to Albert Einstein's establishment of the constant (and limiting) speed of light, among other things.

always had this at least implicitly in mind: I see no recent reported cases on the use of astrology or phrenology, although I am aware of complaints from various parts of the bar that some admitted testimony is no better. Let us settle at least on this for now: *Sargon* gives us a renewed emphasis on logic, 55 Cal.4th at 772, a mandate to test the basic premises of a discipline for signs of science.[182] *Sargon* may, in its approving invocation of Imwinkelried's article and its analysis of Evidence Code § 802 , countenance the trial judge's hard look "into the reliability of an expert's major premise,"[183] that is, trial judges may, and must, determine whether, as a matter of logic, the studies and other information cited by experts adequately support the conclusion that the expert's general theory or technique is valid.[184]

Deciding whether or not an "expert's general theory or technique" is valid may be a bit more than state trial judges are used to outside the *Kelly* "novel technique" context.[185]

A final practical note: a conundrum outside the trial context. Judges often have a pretrial hearing to determine whether an expert may opine. The patient judge in *Sargon* had an 8 day hearing. Having this much time at trial is remarkable enough in our overburdened courts, but we have no similar procedures for other contexts in which judges are asked to rely on expert testimony, such as summary judgment and class action certification motions. Before trial, the parties have had the chance to conduct expert discovery, find a supplemental expert when the other side surprises, and to research proposed expert testimony. At a pretrial hearing, the judge's and parties' questions flesh out the reliability issues.

There is nothing like this in motion practice. Motions are often filed long before the expert disclosure deadlines, parties have a short period to respond and usually none to examine the other side's witness. Yet judges must rule on the admissibility of expert declarations; and these rulings are frequently case determinative.

There may be no good answer here. Expert declarations will have to carry their own water, and burdens of proof will continue to have a decisive impact. Judges may have some flexibility to entertain live witnesses in certain types of hearings, and they can generally postpone hearings to allow for some discovery, but with our present underfunded and understaffed courts, these options will not be readily embraced.[186] Counsel are invited to propose—some experiments.

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[182] Whether my suppositions are accurate or not (perhaps future experiments—which we call cases—will tell!) I must note that Sir Karl's notion of 'science' does not define the scope of expert testimony controlled even by *Daubert*. As *Kumho Tire* says, the same rules apply whether the area of expertise is scientific or not, for they apply to all technical and other areas of expertise. 526 U.S. at 147–148; *United States v. Mitchell*, 365 F.3d 215, 244 (3rd Cir. 2004). Experts might opine on how to mix cement or lawyers' duties, neither of which is 'scientific'. So the terms 'science' and 'scientific' are used in two different ways in this context: as what I have termed a vertical method of determining if any discipline can support expert testimony at all; and as one of the many substantive disciplines arguably the subject of expert testimony.

[183] IMWINKELRIED, *supra* note 7 at 446.

[184] IMWINKELRIED, *supra* note 7 at 449.

[185] Recall that *Sargon*, Evidence Code § 802, and the Imwinkelried article may all apply whether or not *Kelly* is implicated.

[186] After this note was completed the Court of Appeal decided *Garrett v. Howmedica Osteonics Corp.*, 153 Cal.App.4th 693 (2013), in which these very contrasts between trial and motion practice were noted. *Garrett* suggests that because of the liberal construction due to papers filed in opposition to summary judgment motions (including expert declarations), *Sargon*'s gate keeping function is not to be as strictly applied to those papers. The same court tells us that *Sargon* does not present a new rule of law, it just explained Evid. C. §§ 801, 802, etc.

Sargon Enterprises, Inc. v. Univ. of S. California, 215 Cal.App.4th 1495 (2013). For some unpublished decisions on this issue, see *Place v. Bernstein* (2 Dist. July 18, 2013); *Valley Casework, Inc. v. Lexington Insurance Company* (4 Dist. July 10, 2013).