SCIENCE IN THE COURTROOM: THE MOUSE THAT ROARED

The Honourable Mr. Justice Ian Binnie*

[I]f matters arise in our laws which concern other sciences and faculties, we commonly call for the aid of that science or faculty which it concerns, which is an honourable and commendable thing. For thereby it appears that we do not despise all other sciences but our own, but we approve of them and encourage them...[1]

INTRODUCTION

We live in an age dominated by science and technology. The question I want to address is whether the courts are doing a proper job of resolving disputes where an appreciation of such technical matters is necessary. The litigation of scientific and technological issues – symbolized perhaps by the mouse in the courtroom, whether it be the Harvard Mouse[2] or the Stuart Little mouse, a rodent with human brain cells,[3] or even worse, the mysterious Schroedinger's cat which can be shown by physicists to be simultaneously alive and dead[4] – is a prospect that leaves much of the legal community justifiably shaking in its Luddite boots. But however daunting, the task of making courts more science friendly is important to sustaining the legitimacy of courts as dispute resolution institutions.

Science disputes are hitting the courts at an increasing velocity. In cases involving tort, environmental, intellectual property and criminal law, the admission and use of expert scientific or technical testimony is often crucial to the outcome. These cases frequently raise policy concerns that collide. For example, there have

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1 *Buckley v. Rice Thomas* (1554), 1 Pl. Com. 118, 75 E.R. 182 at 184, Saunders J. [*Buckley*].

2 *Harvard College v. Canada (Commissioner of Patents)*, [2002] 4 S.C.R. 45.

3 The *London Times* reported on 2 September 2006 that scientists at Stanford University in California are introducing human brain cells into mice. Stuart Little you will recall is the mouse that can talk and had human parents, but was still a mouse and the *Times*' headline read "A human brain trapped inside a mouse's body – not a good idea". A Stanford law professor, responsible for overseeing the legal and ethical aspects of the Stuart Little experiment, was quoted as saying "Frankly, if we made a mouse that had a fully human brain, I would be concerned". When you have fully human children suing their parents in the United States for wrongfully bringing them into the world, I suspect Stuart Little might have a winner of a lawsuit.

4 Schroedinger's cat is a creature that inhabits the wonderland of quantum physics. You and I may think that a physical object has one state. The book is either open or it is closed. You may be surprised to hear that quantum physicists do not agree and can prove by the principle of "super position" that a physical object can be both – at least at the molecular level.

been very interesting disputes dealing with customized bacteria used to fight oil spills and other pollution, where scientists have designed a bacterium that has no counterpart in nature. But of course, once the pollution is eaten up, the bacteria keep on reproducing. If a court does not understand exactly what was modified and what the consequences of unleashing such organisms into the environment are, how can a court determine legal questions related to liability and remedies? From a scientific standpoint, one of the solutions to the problem of natural reproduction is to build into the organisms a so-called "suicide gene" so that at a certain point, the bacteria simply die. That sounds like a good idea, but then Monsanto came along with a genetically-modified soy bean containing a suicide gene and critics said, "This is contrary to the *Competition Act* because you're forcing the farmer to go back to Monsanto every year to buy seed".[5]

Recently, a group of scientists visited the Supreme Court of Canada. They told us that nanotechnology[6] will create the next big wave of litigation. Harnessing so-called quantum nanotechnology, governments will be able to make devices to listen to private communications, however cleverly encrypted, and the legitimate parties to the communication will not be able to tell whether their communication has been intercepted or not. Other nanoscientists are working on a customized molecule to dust the site of brain surgery. It seems the dust will prevent scar tissue from forming and thus allow the tissue to knit. But what if the dust has disastrous unexpected side-effects? There are also applications of nanotechnology to deliver medicines to the right place in the body. But what is the legal liability if the delivery fails or runs amok and the patient is injured or dies? It is important that parties injured by such scientific initiatives, as well as those defending against the claims, have confidence in a court's ability to understand and evaluate the expert evidence.

Lawyers and Scientists Seem to Inhabit Different Universes

Superficially, and misleadingly, the cultures of the lawyer and the scientist *seem* to have much in common.[7] We all try to act on "evidence" and use comparable indicia of expertise and testing in the search for reliability. Conclusions are drawn from the accumulated evidence through logic, deduction and induction. Yet in truth, we largely inhabit mutually skeptical solitudes, and where these solitudes rub together the result is often not pleasurable for either discipline, especially for the judge. For instance, the idea of "evidence" seems to mean something quite different to scientists than to judges. In science, "evidence" is not equivalent to "proof".[8] For the most

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[5] See *Monsanto Canada Inc. v. Schmeiser*, [2004] 1 S.C.R. 902.

[6] A nanometer is a billionth of a meter. A sheet of paper is about 100,000 nanometers thick. Using various new techniques, in particular something called a scanning tunnelling microscope, scientists can construct new forms of matter at an atomic level.

[7] See generally Alan D. Gold, *Expert Evidence in Criminal Law: The Scientific Approach* (Toronto: Irwin Law Inc., 2003).

[8] *Federal Judicial Center Reference Manual on Scientific Evidence*, 2nd ed., 2000 at 80, online: The Federal Judicial Center <http://www.fjc.gov/public/home.nsf/pages/610> [*Reference Manual on Scientific Evidence*].

part, theories cannot truly be "proved" in the sense that they become indisputable. Almost all scientific conclusions are considered provisional.[9] Theories can be supported by more or less evidence and may eventually come to be accepted as the dominant or most likely explanation of observed phenomena. The phrase "consistent with" to a scientist merely means that something cannot be excluded as an explanation. It does not connote any particular weight, association or commonality. However, to judges, lawyers, and the public this phrase is often interpreted to mean that there is a "match".[10]

The average judge is likely to have little background in science generally; much less particular expertise in the field to which the dispute relates. Even worse, while the lawyers have had months and perhaps years of preparation, the judge hits a dispute cold and is expected to get "up to speed" within a few of days on matters which the expert witnesses have spent a professional lifetime attempting to understand. The predicament of the judge was well summarized by Justice Frank Muldoon, a larger-than-life figure, who sat for years as one of the leading judges in the Federal Court, Trial Division. The topic was a patent dispute involving the dryer-added clothes fabric conditioner called BOUNCE. Unilever had claimed that the coating (animal fat and sugar extract) on the substrate of Procter & Gamble's dryer sheet violated a Unilever patent. Legions of experts were called by both sides to argue about how this animal fat mixture distributed itself on clothing during the dryer cycle. Millions of dollars hung in the balance. After a lengthy trial in which there were periodic outbursts from Muldoon J. complaining that all this talk of surfactants, contact angles, and surface tension was incomprehensible, he eventually exploded in his final reasons for judgment as follows:

> A judge unschooled in the arcane subject is at difficulty to know which of the disparate, solemnly-mouthed and hotly contended scientific verities is, or are, plausible. Is the eminent scientist expert with the shifty eyes and poor demeanour the one whose "scientific verities" are not credible? Cross-examination is said to be the great engine for getting at the truth, but when the unschooled judge cannot perceive the truth, if he or she ever hears it, among all the chemical and other scientific baffle-gab, is it not a solemn exercise in silliness?[11]

As counsel for Unilever, I took little comfort in this *cri de coeur* (although Unilever won the case), but the fact of the matter is that judges and jurors may have no means of assessing credibility except through the usual clues applicable to witnesses generally. Even body language and physical appearance, as Muldoon J. observed,

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[9] Justice Thomas Cromwell & Ronald-Frans Melchers, "Testing the Validity of Scientific Evidence" (National Judicial Institute Conference, *Managing Science in the Courtroom*, Toronto, 23 November 2005) [unpublished].

[10] Gold, *supra* note 7 at 200.

[11] *Unilever PLC v. Procter & Gamble Inc.* (1993), 47 C.P.R. (3d) 479 at 488.

may well be misleading when it comes to expert witnesses.[12] In the absence of anything better, the court may be overly impressed with credentials and reputation, and too little focussed on the validity and content of the scientific testimony itself, which may have been presented in a disjointed and confusing manner.

In a criminal case, the Manitoba Court of Appeal criticised the way in which a scientific point was argued for just this reason:

> It can be seen that Crown counsel was inviting the jury to determine a question of science on the basis of their impression of the demeanour of the witnesses.[13]

Yet the same flaw appears frequently in judge-alone cases. In *Lubrizol Corp. v. Imperial Oil Ltd.*,[14] a patent case involving heavy molecular weight dispersants in motor oils, the evaluation of the expert witnesses by the trial judge includes the following:

> Each witness, especially the expert witnesses, received very careful scrutiny by myself with attention paid not only to their answers, but also to their demeanour, out-of-line advocacy, evasiveness.[15]
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> ...
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> My note on that day reads: "Dr. Klaus would be a better witness if he showed more confidence in counsel who are experienced and competent."[16]
>
> ...
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> After hearing Billmeyer's evidence in reply, I had written as one of my comments: "Impressive, straightforward, very convinced that he's right in his observations and conclusions."[17]

What is the scientific community to think about the administration of justice if experts are to be judged like travelling salesmen on the basis of their ability to project confidence and conviction? One hesitates even to ask. Here are a few representative complaints from some experts who felt "burned" by their trial experience:

1. "There is no opportunity to explain evidence or interpretation oneself, no assurance that counsel will explain it clearly or in a sophisticated fashion, and no opportunity to correct errors or crudities which creep in."

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[12] See also Sanja K. Ivkovic & Valerie P. Hans, "Jurors' Evaluations of Expert Testimony: Judging the Messenger and the Message" (2003) 28 Law & Soc. Inquiry 441.

[13] *R. v. Medvedew* (1978), 43 C.C.C. (2d) 434 at 440 (Man. C.A.).

[14] *Lubrizol Corp. v. Imperial Oil Ltd.* (1991), 33 C.P.R. (3d) 1. While I was not involved in the trial, I disclose that I was one of the lawyers who appeared for Imperial Oil on the appeal(s).

[15] *Ibid.* at 37 per Cullen J.

[16] *Ibid.* at 41.

[17] *Ibid.* at 42.

2. "There is no guarantee that counsel will even understand the arguments the expert has made, and consequently no guarantee that questions which may be posed by the judges will be correctly or clearly answered."

3. "The expert witness is almost entirely at the mercy of counsel on both sides. The expert must depend on counsel to present his or her views fairly and forcefully....[scientists] do not get an opportunity to defend themselves against misquotation or selective quotation by opposing counsel." [18]

A common thread woven through these complaints is the impression (perhaps false) among some scientific experts that the legal system suffers from amateurishness when it deals with scientific matters. Our courts are said not to be scientific enough in their approach to scientific evidence. Legal academics, too, sometimes offer observations surprising enough to make scientists rub their eyes, as in the case of Stéphane Beaulac and Pierre-André Côté, professors of law at the Université de Montréal, who recently wrote with a somewhat shaky grip of the law of gravity:

> Consider a flight from Montreal to London. The pilot must plan such a flight based on a conception of the earth that is round, otherwise the aircraft would end up in outer space.[19]

From a scientist's point of view, a disturbing feature of litigation is the adversarial process itself, under which judges and lawyers assume that the truth is best arrived at by contending parties stating their own (one-sided) point of view as simply, forcefully and with the least amount of nuance possible. Rather than acting as an independent scientific investigator, the judge sits and listens to both adversaries and is supposed to distill from all the conflicting (and perhaps overstated) evidence the "true facts" to which he or she then applies the law. This is the jurist's equivalent of Adam Smith's "invisible hand" in the *Wealth of Nations*.[20] If every litigant furiously pursues their own self-interest in the courtroom then, at the end of the day, the truth will emerge. Many scientists think that this approach is naive and is hardly likely to get to the truth in a matter involving serious learning and sophistication.

Another problem is that, as scientists see it, courts rush in where experts fear to tread. How can a court possibly resolve a products liability case involving the alleged adverse effects of using oral contraceptives,[21] for example, when the experts themselves are divided over the increased risk of strokes? In a class action in the United Kingdom brought by a group of women in Britain against Schering

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[18] J. Morgan Kousser, "Are Expert Witnesses Whores? Reflections on Objectivity in Scholarship and Expert Witnessing" (1984) 6:1 The Public Historian 5.

[19] Stéphane Beaulac & Pierre-André Côté, "Driedger's 'Modern Principle' at the Supreme Court of Canada: Interpretation, Justification, Legitimization" (2006) 40 R.J.T. 131 at 168.

[20] Adam Smith, *An Inquiry Into the Nature and Causes of the Wealth of Nations* (London: 1776).

[21] See *e.g. Buchan v. Ortho Pharmaceutical (Canada) Ltd.* (1986), 54 O.R. (2d) 92 (C.A.), aff'g (1984), 46 O.R. (2d) 113 (H.C.J.).

Pharmaceutical and others,[22] six studies on this relationship were put before the court.[23] Three of these studies, all published in the British medical journal, *The Lancet*, said that there was an approximate doubling of the risk to a woman who was taking the third generation of this pill.[24] There were also three industry-sponsored reports which said that there was no increase in the risk. The studies, written largely in algebra, landed before the unfortunate Mr. Justice Mackay. He accepted as persuasive the industry reports, dismissed the action, and was then virtually universally condemned in the medical literature. An editorial in *The Lancet*, stated that "trying science in a court of law is doomed to failure".[25] The editorial went on to say, "[d]espite millions of pounds spent, and numerous intelligent minds locked in combat, the judge failed utterly to get to the heart of the matter".

There is a further problem. The judge may not have the luxury of waiting until scientists in the relevant field have reached a consensus. The court is a dispute resolution forum, not a free-wheeling scientific inquiry, and the judge must reach a timely decision based on the information available. Even if science has not figured it out yet, the law cannot wait. This problem was in the forefront of the late Justice Sam Grange's mind when he was faced with reaching conclusions in his Commission of Inquiry into deaths at the Hospital for Sick Children in Toronto. He wrote:

> I cannot await the research. I am charged to find the cause of death of thirty-six children. Obviously toxicologic information is important. I must accept the best information available at least if it is not seriously challenged in the present state of science. I may eventually be proven wrong because the toxicologic evidence upon which I in part based my conclusion may be proved wrong or inadequate [but] that is how I interpret obedience to my mandate.[26]

It is Easier for Lawyers to Attack the Testifier than the Testimony

Even if knowledgeable about the specific scientific issues in a case, lawyers, being practical people, are sensitive to the dangers of overloading the finders of fact, whether judge or jurors, with too much jargon and complexity, scientific or otherwise. The skilful cross-examiner may have soaked up the elements of the science at issue in a particular case, but will often find it easier and more effective to

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[22] *XYZ & Others v. Schering Health Care Ltd., Organon Laboratories Ltd., John Wyeth & Brother Limited*, [2002] EWHC 1420 (Q.B.).

[23] See Editorial, "Epidemiology on trial" (2002) 360 The Lancet 421; News, "Third Generation Pill Not More Risky" (2002) 269 The Pharmaceutical Journal 149.

[24] Haroon Ashraf, "UK high court dismisses risk of VTE in 'pill' test case" (2002) 360 The Lancet 391.

[25] Editorial, *supra* note 23.

[26] Ontario, *Report of the Royal Commission of Inquiry Into Certain Deaths at the Hospital for Sick Children and Related Matters* (Toronto: Royal Commission, 1984) at 29-30.

discredit the expert witness than to demolish the scientific basis on which the witness's testimony rests.

A good example is the cross-examination of a scientific expert conducted by one of Canada's great criminal lawyers, G. Arthur Martin, in the celebrated Stephen Truscott murder case when it was "retried" before the Supreme Court of Canada in 1966.[27] The accused was a teenager; the victim, a girl named Lynn Harper, who was of about the same age, and was last seen alive in Truscott's presence. One of the strongest arguments for the defence was that Truscott could not have murdered Lynn Harper in the narrow window of opportunity contemplated by the prosecution. The evidence was that Lynn had eaten her supper at a quarter to six the night she was killed. Steven Truscott had a strong alibi from 8:00 p.m. onwards. The Crown therefore had to establish that Lynn was murdered within two hours of her last meal, and for that purpose called a pathologist to testify that the precise time of death could be established from the state of digestion of the contents of her stomach. Arthur Martin's task was to undermine the testimony of the pathologist. He did so using a dry sense of humour rather than by debating the correctness of the pathologist's science. Here is an extract from the trial transcript:

> Q. Now, you have written extensively, Dr. Simpson, in the field of forensic medicine.
>
> A. Yes.
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> Q. Now, I have read a good many of your books and one of the books you have written is entitled *Forensic Medicine* and, as my learned friend Mr. Scott says, it has gone through five editions now?
>
> A. Yes.
>
> Q. And in the last edition, indeed, you say this edition has been combed to insure it is abreast of the times. I notice at page 7 of the book - of course, I quite realize here you are dealing with a post-mortem event - you say under the heading of "Cooling":
>
> "This is the only real guide to the lapse of time during the first eighteen hours after death, and its *early* measurement is often vital to the establishment of an approximate time of death."
>
> A. Yes, sir.
>
> Q. Do you, anywhere in this book, suggest that the stomach contents and the state to which digestion has proceeded following the last meal is a reliable guide to the time of death?
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> A. No sir: I think that that is, as may be evident to you, a short book for the student.

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[27] *R. v. Truscott*, [1967] S.C.R. 309.

Q. It would not have made it much bigger to put in a sentence indicating that stomach contents were also a reliable guide?

A. No sir: I appreciate that, but it is not intended to be a comprehensive work, of course.

Q. It should contain the things upon which there is greater consensus –

A. I think you may expect the next edition, sir, to contain some reference.

Q. You are going to change the next edition?

A. I think it is how one improves one's textbooks, by experience.

Q. When did you decide to change the next edition?

A. Each time I am writing I am learning and each case I have helps me to improve the next edition.

Q. I will throw this away and buy the next edition...[28]

The striking feature of the cross-examination is that it essentially ignored the merits of what the pathologist was trying to say. Counsel declined to take the witness (and the court) into the underlying science. The trier of fact was no doubt struck by the inconsistency between what the pathologist had written in his book and what he was now ready to swear to, but would have been none the wiser as to which version was correct.[29]

Arthur Martin's possible distrust of a non-expert court to appreciate the underlying science may have been wise, although in the end the conviction of his client was affirmed.

Does the Trial Process Work Effectively Where Science is Involved?

In some cases, it is clear that the scientific issues have not been properly understood. Take as an example the 7,000 lawsuits pending against Merck in respect of its drug Vioxx. In the first of those lawsuits to go to trial, Merck was found liable by a jury to pay U.S. $253 million to a single claimant. Merck said the deceased did not at all fit the Vioxx risk profile because he had taken Vioxx for only a few weeks before his fatal heart attack, whereas Merck's scientific evidence suggested a danger threshold of about 18 months.[30] Merck brought experts to court in an effort to show that there was no reputable scientific basis to the plaintiff's claim. Not only was Merck's

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[28] Reproduced in Arthur Maloney, "Expert Evidence" in *Special Lectures of the Law Society of Upper Canada, Defending a Criminal Case* (Toronto: Richard De Boo, 1969).

[29] Interestingly, in the August 2006 inquiry into the case, referred to the Ontario Court of Appeal by the Federal Justice Minister, experts were called who said that it was simply impossible to judge by the state of digestion, the time from ingestion to death: Tracy Tyler, "Noted pathologist slams 'ludicrous' methodology" *The Toronto Star* (8 July 2006) A15.

[30] Ann Woolner, "A thin case against Vioxx" *Ottawa Citizen* (27 August 2005) B7.

evidence not accepted, but the following was reported from a post-trial press conference held by the jurors:

> Whenever Merck was up there it was like "wah wah wah", juror John Ostrom told reporters, "we didn't know what the heck they were talking about".[31]

Whether or not Merck's case was valid, such an outcome is wholly unsatisfactory. In some measure this may be the fault of the trial process which, some critics argue, includes the following weaknesses:

(a) the non-sequential presentation of evidence, which can be confusing, *e.g.* skipping from issue to issue or back and forth between fact witnesses and expert opinion witnesses;

(b) evidence which is selected and arranged by parties in a way that may be self-serving, but potentially misleading unless effectively countered;[32]

(c) counsel who may not have sufficient background and familiarity with a particular scientific area to cross-examine the opposing party's experts effectively;[33]

(d) "professional" hired-gun, incompetent or ideological witnesses who may deflect the debate from the real issues;

(e) cross-examination which can undermine trustworthy sources for reasons other than scientific validity, yet fail to discredit opposing testimony of less merit that is delivered with greater presentational skill; and

(f) some evidence which may be important from a *scientific* perspective may be excluded because of admissibility rulings, while other weak or controversial evidence may be admitted, depending on how the judge exercises the gatekeeper role.

The result of these weaknesses? Wah wah wah.

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[31] *Ibid.*

[32] In *R. v. F.(D.S.)* (1999), 23 C.R. (5th) 37 (Ont. C.A.) the Court declined to set aside the conviction because, in part, at trial it was open to the defence to challenge the expert's general statements about the empirical or scientific support for her opinions and it failed to do so. In *R. v. Blanchard*, [1996] N.J. No. 319 at para. 6 (Nfld. C.A.) (QL), the Newfoundland Court of Appeal dismissed an appeal, stating that "in light of [the expert's] education, experience, research and extensive history in analysis of animals, which includes 160 appearances before courts in Ontario, the Maritimes and Newfoundland, it is difficult to see how the trial judge could do otherwise than admit the evidence in the absence of testimony on a *voir dire* supporting the contention of the defence that no such field of expertise exists."

[33] In *R. v. D.D.*, [2000] 2 S.C.R. 275 at 300, the Court stated that "[E]xpert evidence is highly resistant to effective cross-examination by counsel who are not experts in that field. In cases where there is no competing expert evidence, this will have the effect of depriving the jury of an effective framework within which to evaluate the merit of the evidence."

A Revised Approach to the Admission of Science and Technology Evidence

Historically, the common law courts judged science by seeking to ascertain the prevailing consensus (if any) in the scientific community.[34] This came under criticism as the velocity of scientific advances accelerated. The courts were frequently faced with "novel science"[35] where there was no opportunity for consensus to form about its validity or invalidity.

The consensus approach was rejected in the United States in 1993 in the *Daubert* case, where the U.S. Supreme Court held that *legal* admissibility should henceforth be based on *scientific* validity not scientific *consensus*, writing that "[i]n a case involving scientific evidence, *evidentiary reliability* will be based upon *scientific validity*."[36] The real issue is not what the experts say, how qualified they are to say it, or whether a consensus has formed in the relevant scientific community, but whether the experts have established in their evidence a scientific basis for their testimony. The judge should take a more active gatekeeper role, perhaps reflecting a lingering mistrust of juries who, under the *Daubert* approach, would never get to hear the evidence if the judge slammed shut the metaphorical gate.

The present position is this: scientific opinion, to be admissible before the jury (or the judge sitting alone), must be (i) necessary – i.e. not within the usual understanding of non-experts; (ii) valid – the science measures what it is supposed to measure; and (iii) reliable – the result is reproducible. The presumption is that to be scientific, a statement must be testable; that is, susceptible to evidence that could potentially show it to be false (if it is indeed false).[37] As a result, post-*Daubert*, the courts have found it harder to evaluate the validity of the science than pre-*Daubert* when all they had to determine was whether a consensus did or did not exist.[38] The

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[34] Under the consensus approach, the scientific principle on which the evidence is based must be "sufficiently established to have gained general acceptance in the particular field in which it belongs": *Frye v. United States*, 293 F. 1013 at 1014 (D.C. Cir. 1923) [*Frye*].

[35] By "novel science" is meant "science at the frontiers of knowledge" where "theories are vulnerable" versus "textbook science" which is known with "great confidence"; see David Goodstein, "How Science Works" in *Reference Manual on Scientific Evidence*, *supra* note 8 at 79. The line between novelty and general acceptance is fuzzy - referred to in *Frye*, *ibid.* as the "twilight zone between the experimental and the demonstrable".

[36] *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 at n. 9 (1993) [emphasis in original] [*Daubert*].

[37] See Susan Haack, "Trial and Error: The Supreme Court's Philosophy of Science" (2005) 95:S1 *American Journal of Public Health* S66, reproduced in (2006) 41 *The International Society of Barristers Quarterly* 376 at 378.

[38] At least one commentator says that *Daubert* "has produced a minefield clogged with '*Daubert* hearings' that are more lengthy, technical, and diffuse than anything that preceded them". See David Crump, "The Trouble with *Daubert-Kumho*: Reconsidering the Supreme Court's Philosophy of Science" (2003) 68 Mo. L. Rev. 1.

Daubert approach requires a level of scientific sophistication on the part of the judge that the earlier consensus approach did not.[39]

The *Daubert* test has gained acceptance in Canada, particularly when screening novel science, which is subjected to "special scrutiny to determine whether it meets a basic threshold of reliability".[40] In *R. v. J.-L.J.*,[41] a prosecution for sexual abuse of children, the defence called an expert to testify that the accused had no disposition towards pedophilia. The Supreme Court of Canada explicitly accepted the four *Daubert* factors as "ones that could be helpful in evaluating the soundness of novel science". These are:

(1) whether the theory or technique can be and has been tested:

> Scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry.

(2) whether the theory or technique has been subjected to peer review and publication:

> [S]ubmission to the scrutiny of the scientific community is a component of "good science", in part because it increases the likelihood that substantive flaws in methodology will be detected.

(3) the known or potential rate of error or the existence of standards; and

(4) whether the theory or technique used has been generally accepted:

> A "reliability assessment does not require, although it does permit, explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community."

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[39] An expertise modestly disclaimed by some U.S. lower court judges, including the lower court judges in *Daubert* itself;when the case was returned to the courts in California, Kozinski J. observed:

> Our responsibility, then, unless we badly misread the Supreme Court's opinion, is to resolve disputes among respected, well-credentialed scientists about matters squarely within their expertise, in areas where there is no scientific consensus as to what is and what is not "good science", and occasionally to reject such expert testimony because it was not "derived by the scientific method". Mindful of our position in the hierarchy of the federal judiciary, we take a deep breath and proceed with this heady task.

See U.S. Court of Appeals for the Ninth Circuit following remand of *Daubert* by the Supreme Court: *Daubert v. Merrell Dow Pharmaceuticals*, 43 F.3d 1311 at 1316 (9th Cir. 1995).

[40] *R. v. Mohan*, [1994] 2 S.C.R. 9 at 25.

[41] *R. v. J.-L.J.*, [2000] 2 S.C.R. 600 [*J.-L.J.*].

> Widespread acceptance can be an important factor in ruling particular evidence admissible, and "a known technique which has been able to attract only minimal support within the community," ...may properly be viewed with skepticism.[42]

Rehnquist C.J., dissenting in *Daubert*, expressed skepticism about the new test. He thought it unlikely that the quality of a scientific proposition could ever be properly evaluated by a court that lacks the necessary background knowledge and expertise. In later cases, the U.S. Supreme Court has somewhat refined its approach.[43]

Testing for "Junk Science"

The courts have responded with varying degrees of enthusiasm to this new role, as have the experts, some of whom obviously believe that giving the judges too much disclosure about the methodology risks confusion. In *J.-L.J.* itself, for example, the accused was exposed to various suggestive photographs while his penis was attached to an instrument called a penile plethysmograph. His penile response was measured. Lack of any measurable response was equated with repugnance to sex with small boys. The legal question was whether this sort of test could be remotely helpful to the court in determining the guilt or innocence of the accused. The expert declined to share his data with the trial court. Here is the somewhat offensive explanation he provided:

> Listen, Your Honour, we have to understand that if we start – normally we do not submit the psychological tests in detail or the curves because at that point if we start calculating everything in centimetres or millimetres, we will be here all morning. Let's just say that this curve, properly analysed, demonstrates the following results, that there are no, according to how those curves are normally evaluated, there are no signs of deviant behaviour in him.[44]

Elsewhere, the expert explained why he had not produced for the court the data on which he based his opinion:

> Okay. But it is not normally produced because otherwise, it would be too complicated to produce all the details, there would be battles over the little details.[45]

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[42] *Ibid.* at para. 33.

[43] *General Electric Co. v. Joiner*, 522 U.S. 136 (1997); *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).

[44] *J.-L.J.*, *supra* note 41 at para. 57.

[45] *Ibid.* As pointed out in *General Electric Co. v. Joiner*, *supra* note 43 at 146, "...conclusions and methodology are not entirely distinct from one another. ...[N]othing in...*Daubert*...requires the...court to admit opinion evidence which is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion..."

The Quebec Court of Appeal had ordered a new trial on the basis that the trial judge ought to have admitted the evidence and left its weight to be assessed by the jury. The Supreme Court reversed the Court of Appeal decision and upheld the trial judge's ruling that the evidence was simply inadmissible because it had not been shown to be either relevant or reliable.[46] Penile plethysmography is a technique that is said to have some utility in measuring the success of treatment of known pedophiles, but has no track record in diagnosing pedophilia in the case of an individual who categorically denies any such orientation. In other words, the expert had overstepped the boundary of his admitted expertise.

In other cases, both the experts and the judge have taken each other seriously, as in the recent re-run of the 1925 Scopes "monkey trial" in Pennsylvania.[47] The parents of some school children challenged their local school board's directive to include "intelligent design" in the curriculum of a high school biology class as an alternative to Darwin's theory of evolution. The school board was overruled by the Court on the basis that the theory of intelligent design "is grounded in theology not science" and has no place in a biology class. Intelligent design was found to be lacking in testability.

Honourable mention might also be made of the bizarre U.S. case of *Iowa v. Harrington*[48] where the trial court was asked to admit novel scientific evidence of alleged brain fingerprinting. According to the *Globe & Mail*:

> For two decades, Terry Harrington protested his innocence from his Iowa prison cell, insisting that he had not shot and killed a retired police officer when he was 17 years old. Then he decided to try brain fingerprinting. It's a computerized mind-reading technique developed by Jerry Farwell, an American researcher and entrepreneur who says he can tell if the details of a crime scene are stored in a suspect's brain. If Mr. Harrington were innocent, the test would show that his brain did not recognize details about the murder, details the killer would know. "The brain never lies," Dr. Farwell says.
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> In February 2003, a judge in Iowa accepted the results of the brain-fingerprinting test, the new testimony from a key prosecution witness and the suppressed police reports. The Iowa Supreme Court overturned his conviction, and ordered a new trial. By then, he had been in prison for 25 years. He was released on bail. In October, 2003, the charges were officially dropped. Mr. Harrington, is suing the police.[49]

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[46] The top four problems identified by U.S. Federal Judges: experts abandon objectivity; excessive expense; questionable validity or reliability; and conflict among experts that defies reasoned assessment. See Carol Krafka et al., "Judge and Attorney Experiences, Practices and Concerns Regarding Expert Testimony in Federal Civil Trials" (2002) 8 Psychol. Pub. Pol'y & L. 309.

[47] *Kitzmiller v. Dover Area School District*, 400 F.Supp.2d 707 (M.D. Pa. 2005).

[48] *Iowa v. Harrington*, 659 N.W. 2d 509 (Iowa Sup. Ct. 2003).

[49] Anne McIlroy, "Not guilty: 'the brain never lies'" *Globe & Mail* (5 November 2005) F6.

The idea of brain fingerprinting has some intuitive attraction as a technique to record an involuntary response, much as a lie detector is supposed to do, but there is considerable doubt as to whether, at this stage of its development, the technique achieves what it is claimed to do, and whether its results are reproducible.

Difficulties with the Gatekeeper Function

It must be admitted that many courts are continuing to have serious difficulties in digesting and evaluating scientific evidence, even rather crude scientific evidence. This is for both institutional and procedural reasons.[50] Institutionally, judges hesitate to exclude such evidence in a jury case for fear of usurping the fact finding function of the jury. Procedurally, in a judge alone case, there is always a temptation to let the evidence in, fully understood or not, and for the judge to leave it to the end of the trial to determine what weight, if any, it is to be given. Either way, the result can be an enormous waste of time and money and, in some cases, a miscarriage of justice.

In 2005, for example, the media were full of reports of another wrongful conviction based on identification of an accused as a murderer by the novel science of barefoot morphology.[51] Mr. Dimitre Dimitrov, a Bulgarian immigrant living in Ottawa, had been convicted four years earlier of murdering his landlord, who was also Bulgarian, by beating him to death with a blunt instrument. There was some evidence of mutual hostility, but there was nothing to tie Dimitrov to the murder except, according to the prosecution, a pair of boots that were covered with stains of blood which the Crown alleged belonged to the victim. There were no eye witnesses. The onus was on the prosecution to connect the boots to the accused. Royal Canadian Mounted Police (RCMP) Sergeant Robert Kennedy testified that the impressions people's feet leave on the insoles of footwear are quite distinct and that

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[50] See *e.g.* Sidney N. Lederman, "Judges as Gatekeepers: The Admissibility of Scientific Evidence Based on Novel Theories" in Joost Blom & Hélène Dumont, eds., *Science, Truth and Justice – Canadian Institute for the Administration of Justice* (Montréal: Les Éditions Thémis, 2000) 217. Justice Lederman suggests that Canadian courts should adopt American-style "*Daubert* hearings" that would require experts to file comprehensive reports and that would permit discovery of the experts. The application of the *Mohan* criteria already requires a *voir dire* which can become quite lengthy in some cases. Ideally, a *Mohan* hearing should be done before the trial is underway to give a judge more time to rule on the admissibility of the preferred testimony. This would also assist counsel, who would know in advance whether their expert will be allowed to testify. Pre-trial discoveries or hearings would require advance disclosure by counsel, including disclosure of the methodology on which the expert anchors his or her conclusions.

[51] *R. v. Dimitrov* (2003), 68 O.R. (3d) 641 (C.A.) [*Dimitrov*].

by applying techniques of barefoot morphology he could say that Dimitrov was "likely" the usual wearer of the boots.[52]

Sgt. Kennedy is an expert in footprint identification. He could opine whether a running shoe imprint in the mud beside a body was consistent with the type of running shoe worn on the day in question by an accused. But here there was none of that; there was only a blood-stained boot. However, Sgt. Kennedy had also developed a sideline expertise trying to identify suspects by the imprint left by feet *inside* shoes or boots, specifically the pattern left by the weight-bearing portions of the bare foot on the insole.[53] The main proponent of barefoot morphology in Canada and the U.S. is RCMP Sgt. Kennedy himself.

The Ontario Court of Appeal concluded in 2003 that Sgt. Kennedy should have been stopped at "the gateway" by the trial judge.[54] His evidence of "barefoot morphology" failed to meet any of the criteria set out in *Daubert* and *R.* v. *J.-L.J.*: there was no serious test of Sgt. Kennedy's hypothesis, and as such there was no

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[52] "Barefoot morphology" theory is a "novel science" that forms part of an explosion of identification techniques. In *People v. Davis*, 304 Ill.App.3d 427 (1999), a man was convicted of first degree murder where the only evidence connecting him to the scene of the crime was a set of lip prints on a roll of duct tape found near by. A forensic specialist testified that the same procedures used in the comparison of fingerprints could apply to "lip prints" which, he said, are just as individualized as fingerprints. The man was convicted. His appeal was dismissed, notwithstanding the fact that the trial judge failed to even hold a "gatekeeper" hearing as required by Illinois law. The Illinois Court of Appeal concluded at 437-38 that:

> the method they employed to identify the lip print was the same as the well-accepted method of fingerprint identification which is accepted as a means of identification by the forensic science community... . Consequently we find that the method employed to identify lip prints, a side-by-side comparison, is reliable.

The Court appeared to be satisfied by the fact that the expert who performed the analysis "[was] unaware of any dissent in the field regarding the methodology used to make a positive identification lip print." Convincing? Similarly, in another case, a man was convicted on the basis of "ear print" identification although the conviction was overturned on appeal: *State v. Kunze*, 112 Wash. App. 1023 (2002).

[53] In Canada, evidence of "barefoot morphology" was accepted in *R. v. Légère* (1994), 156 N.B.R. (2d) 321 (C.A.), but rejected in *R. v. Sood*, [1997] O.J. No. 5417 (Gen. Div.). Sgt. Kennedy has also testified in some American cases: *State (South Carolina) v. Jones*, 541 S.E.2d 813 at 818-19 (S.C. 2001) and *State (North Carolina) v. Berry*, 546 S.E.2d 145 (N.C. 2001).

[54] *Dimitrov*, *supra* note 51. In setting aside Dimitrov's original conviction, the court said the trial judge had not performed a proper gatekeeper role (at paras. 55-56):

> In our view, the slight probative value of Sergeant Kennedy's evidence was outweighed by its prejudicial effect. The risk that the jury might be over-awed by Sergeant Kennedy's expertise was a real one in this case. The evidence occupied a day and was augmented by diagrams, a lengthy discussion of the study of barefoot analysis and technical language about anatomy and laboratory procedures.
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> ...
>
> In light of the significant issues as to reliability of the evidence, its lack of logical relevance and the risk of distortion in the fact-finding process, the trial judge erred in principle in admitting Sergeant Kennedy's evidence.

opportunity for peer review and no error rate could be established. The Court therefore set aside Dimitrov's original conviction on the basis that the trial judge had not performed a proper gatekeeper role. At the retrial in 2006, Dimitrov was readily acquitted.

What is to be Done?

There are many kinds of science, and courts may therefore have to develop different approaches to gate-keeping depending on the type of science or technology at issue.[55] Some areas of claimed expertise are more easily validated and reproduced than others. DNA evidence methodologies, for example, lend themselves more easily to testing, critique and the generation of error rates than do theories in the softer sciences, such as psychology. Nonetheless, there are a number of ways to try to help non-scientists evaluate science to the extent necessary to resolve a particular dispute.

(A) *Judicial Education*

Much greater effort on both the general and particularized education of judges and lawyers is overdue. (This may not help jurors, but it is the judge who acts as the gatekeeper.) The National Judicial Institute has taken the lead to bring groups of Canadian judges together to explore scientific concepts and subjects that may give rise to litigation. On a more specialized level, the Einstein Institute for Science, Health & the Courts (EINSHAC), a Washington based non-governmental organization, has held many seminars for judges in genetics and biotechnology.[56] If nothing else, by attending at these seminars judges gain some familiarity with the jargon and methodology in a setting less stressful than that of a trial. Of course, judges would be better off still if their education had started at a younger age, but scientific legal education has traditionally been a matter largely neglected in our law schools. Recently, this shows signs of improvement.[57] At Dalhousie, there is now a course on *Law and Technology* which covers genetic modifications in plant and animal materials for food and agriculture, developments in telecommunications, privacy concerns, access to information, ethics in technology, and so on. The

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[55] Michelle M. Mello & Troyen A. Brennan, "Demystifying the Law/Science Disconnect" (2001) 26 J. Health Pol. 429.

[56] Some critics are concerned that a little knowledge is a dangerous thing. Professor Susan Haack says she is:

> ...a little worried about the danger of giving judges the false impression that they *are* qualified to make subtle scientific determinations, when it is hardly realistic to expect that a few hours in a science seminar will transform judges into scientists competent to make subtle and sophisticated scientific judgments – any more than a few hours in a legal seminar could transform scientists into judges competent to make subtle and sophisticated legal determinations.

See *supra* note 37 at 388.

[57] Surveyed 21 July 2006.

Université de Montréal has a course dealing specifically with "la preuve scientifique au soutien des recours civiles et pénaux". These courses try to teach law students how to manage scientific proof. Other universities are also beginning to get their students into this area, and as well they should.[58]

(B) *Judicial Recruitment*

Traditionally, little effort has been made in Canada to recruit judges with a scientific or engineering background. This is true even of the Federal Court where most intellectual property litigation takes place.[59] This lacuna should be addressed. In the *Lubrizol v. Imperial Oil* litigation mentioned earlier, the German Patent Court, which seems to be composed entirely of expert scientists, had invalidated Lubrizol's Meinhardt patent, on which its case in Canada depended, as "obvious" in light of the prior science. The trial judge in our Federal Court disagreed. In an era where intellectual property is global, it is unfortunate to have inconsistent pronouncements of this sort. Where our judges differ from foreign courts on matters of science and technology, it is important that commercial litigants are satisfied that the courts in both jurisdictions, despite their differences, have understood and properly weighed the conflicting scientific perspectives.

(C) *Modify the Adversarial System*

Assuming that the judge does take his or her role as the evidential gatekeeper seriously, whether presiding with a jury or alone, the present trial system still has too many systemic problems that get in the way of the court truly understanding the underlying science and technology.[60]

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[58] For example, McGill University offers a course on medical liability, the University of Ottawa has a course on forensic science, Osgoode Hall has a medical/legal seminar that covers expert scientific witness testimony and basic medical information, the University of B.C. has a quantitative methods in law course, l'Université de Sherbrooke has a course on molecular biology and the law and the University of Windsor has a law and medicine class.

[59] This seems to also be the case in the United States where a judge put it this way:

> Judges, trial and appellate, generally are not recruited from within the ranks of behavioral research scientists. They tend to have little formal, post-secondary, science education...except as provided in continuing judicial education programs. They tend to have no particular training in statistical analysis as it relates to scientific research. In short, they tend to be scientifically ignorant, which means they are not acquainted with, let alone conversant, with scientific practice or language.

See Gold, *supra* note 7 at 19 citing Alan G. Gless, "Some Post-Daubert Trial Tribulations of a Simple Country Judge: Behavioural Science in Trial Courts" (1995) 13 Behav. Sci. & L. 261 at 262-63.

[60] In Alberta, the *Rules of Court Project* is concerned with such procedural matters as efficiency and the cost of expert evidence, but some of the proposed reforms may have a secondary benefit of tempering some of the excesses of the adversary system by providing for court-appointed experts, referees or advisors. See Tania M. Bubela, "Expert Evidence: The Ethical Responsibility of the Legal Profession" (2004) 41 Alta. L. Rev. 853.

In the first place, our present system contemplates that a case must be resolved on the evidence heard in the courtroom. Yet the courtroom, with all its formalities and evidentiary rules is a poor schoolhouse, and duelling experts may make bad teachers.[61] Courts are, however, the masters of their own procedure and have the flexibility to modify to their own advantage the framework within which experts testify. Why, for example, in a case that requires a judge to grapple with serious scientific evidence, can the parties not arrange for an out-of-court seminar on basic science specific to the dispute? This was done for a panel of judges in the House of Lords in *Kirin-Amgen Inc. v. Hoechst Marion Roussel Ltd.*,[62] a patent case, where it was explained at paragraph 135 of the decision:

> ...the work which Professor Yudkin did by means of carefully prepared seminars enabled all those involved to concentrate on the issues of law in the appeal without having to spend a good deal of extra time in the course of the hearing on learning about the technology. This had the result of shortening the length of time that it was necessary to devote to the hearing by several days. It was at Lord Hoffman's suggestion in the course of a preliminary hearing that this was done as there was no dispute about the technology. I suggest that it is a course which might usefully be adopted in the future in cases of this kind, where the technology is complex and undisputed and the parties are willing to consent to it.

As previously stated, the case of *Lubrizol v. Imperial Oil* involved patent claims to certain heavy molecular weight dispersants in automotive lubricating oils. This required such esoteric exercises as comparing *number* average molecular weights with *weight* average molecular weights of certain components. The scientific concepts and definitions were not contested, only their application. It would have been desirable, I think, to have locked the judges alone in a room with a couple of experts appointed and paid for by the parties, to go over the common ground informally. In that setting, the judges could have engaged themselves in an open discussion and asked questions that no doubt they would have hesitated to ask in court, where judges are expected to sit Madame Tussaud-like listening passively to

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[61] "Developments in the Law: Confronting the New Challenge of Scientific Evidence" (1994) 108 Harv. L. Rev. 1481 at 1586. See also Paul Michell & Renu Mandhane, "The Uncertain Duty of the Expert Witness" (2005) 42 Alta. L. Rev. 635 on the possibility of court-imposed codes of conduct for experts. In Australia and some other common law jurisdictions, there is a move towards emphasizing the duty of an expert to provide the court with complete, objective and non-partisan information; to this end, some courts have developed guidelines and codes of conduct that must be signed by the expert. In the U.S., the American Medical Association and the American Psychological Association have professional responsibilities and ethics explicitly incorporated in their respective Codes of Conduct for members involved in litigation. See also United Kingdon, *Civil Procedure Rules* r. 35.7; Australia, *Uniform Civil Procedure Rules 2005* (N.S.W.) Sch. 7, r. 31.23 and r. 31.30; Australia, *Uniform Civil Procedure Rules 1999* (Qld) r. 426; and New Zealand, *High Court Rules* (N.Z.) r. 330A. See generally Bubela, *ibid.* at para. 28; and Peter Wardle & Danny Cappe, "Reforming Ontario's Expert Evidence Rules" (Paper presented to Into the Future: The Agenda for Civil Justice Reform, April 2006), online: Canadian Forum on Civil Justice <http://www.cfcj-fcjc.org/IntoTheFuture-VersLeFutur/advocatesPapers.htm>.

[62] *Kirin-Amgen Inc. v. Hoescht Marion Roussel Ltd.*, [2005] 1 All E.R. 667.

what they are being told, often without knowing where the common ground ends and the controversy begins.

Prior to a trial, better use could also be made of case management.[63] A judge who is assigned early in a "science" case to deal with all interlocutory issues may acquire a decent understanding over time of the underlying science. This may also provide an early springboard to discuss issues about presentation of technical evidence at trial. At present, in many Canadian jurisdictions, interlocutory matters in the same case may be assigned to different judges according to the vagaries of the judicial calendar, and the trial judge may have no prior exposure to the issues until the case opens. Judging from the reaction of Muldoon J. in the BOUNCE case, that initial *dévoilement* can be an appalling experience for everyone concerned.

Once the hearing begins, consideration might be given to a court-appointed expert nominated by the parties to sit with the judge or jurors to respond to their questions within the relevant field of expertise. In some cases, it may be appropriate for the court to take the initiative in appointing its own scientific *amicus curiae* to provide assistance in evaluating the scientific evidence, even without the consent of the parties.[64] This is the tradition in some continental legal systems, and is the practice in British admiralty courts[65] (which have a civil law genesis) as well as our

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[63] For example, a case management judge could impose trial segmentation to separate causation, liability and damages phases. This might help address problems caused by technological inexperience of the decision-makers. It would also limit the number of issues that a judge or jury must consider in a single phase of the trial. The downside is that it may also result in a measure of duplication and repetition.

[64] See *e.g.* Federal Rule 706 in the United States and Order 34 of the Australian Federal Court Rules, *Statutory Rules 1979 No. 140* made under the *Federal Court of Australia Act 1976*, which provides:

> 2. Appointment
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> (1) If a question for an expert witness arises in a proceeding, the Court may, at any stage of the proceeding:
>
> (a) appoint an expert as court expert to inquire into and report upon the question;
>
> (b) authorize the court expert to inquire into and report upon any facts relevant to the inquiry and report on the question;
>
> (c) direct the court expert to make a further or supplemental report or inquiry and report; and
>
> (d) give such instructions as the court thinks fit relating to any inquiry or report of the court expert.
>
> . . .
>
> (3) Instructions pursuant to paragraph (1)(d) may include provision concerning any experiment or test for the purposes of any inquiry or report of a court expert.

[65] See *e.g. The "British Resource"* (1942), 73 Ll. L. Rep. 143 (H.L.) at 144-45:

> One could understand the difficulty of a layman appreciating that on a dark night ships could be seen at a distance sufficiently great to enable [the collision] to be avoided. Therefore it was particularly a matter for expert opinion, and in this case our nautical assessors had advised that the ships should have seen each other.

own Federal Court sitting in admiralty.[66] Care must be taken, of course, to ensure that the litigants are not ambushed by the advice given by the assessors and that the principles of natural justice are observed: see *Porto Seguro Companhia De Seguros Gerais v. Belcan S.A.*[67] In England, there is a Rule of Practice permitting the Court of Appeal to appoint its own scientific advisor in a patent appeal.[68]

As to the expert evidence presented by the parties, the rules of procedure should be modified to require experts to exchange reports and meet face-to-face for an unmediated discussion before trial. Evidence of the results of scientific experiments done specifically for the trial should be excluded unless witnessed by the other side. The court should be able to order opposing experts to produce a joint report which defines key terms as well as the points of agreement and disagreement. Moreover, the court should be able to require opposing experts to testify on the same panel and be subject to questioning in the presence of each other, with the right to question each other in the presence of the trier of fact. The procedure whereby opposing experts testify together on the same panel is regularly used in continental legal systems as well as by administrative agencies in Canada, such as the National Energy Board, and is employed with success in the Federal Court of Australia (where it is known as the "Australian hot pot").[69] Experts testifying in the presence of one another are likely to be more measured and complete in their pronouncements, knowing that exaggeration or errors will be pounced upon instantly by a learned colleague, as opposed to being argued about days later, perhaps by unlearned opposing counsel.

Finally, the parties to these complex cases have a legitimate expectation that the reasons for judgment (where the case is tried without a jury) will make it clear the judge has heard and understood the technical aspects of the case. While in Canada, jurors cannot be asked about their deliberations (therefore no "wah wah wah"), a case heard by a judge alone should result in a decision that traces the judge's pathway through the scientific evidence to the result. In this way, the trial judge establishes a better record for review by the appeal court, and provides assurance to the parties as well as the broader public that the issues have been properly addressed.

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[66] *Federal Court of Canada Rules*, S.O.R./98-106, Rule 56, "Role of Assessor".

[67] *Porto Seguro Companhia De Seguros Gerais v. Belcan S.A.*, [1997] 3 S.C.R. 1278 at para. 40, McLachlin J.:

> I conclude that the old admiralty rule appointing assessors to assist the judge in making findings of fault to the exclusion of expert evidence should be revised. First, assessors should be permitted to assist judges in understanding technical evidence. Second, assessors may go further and advise the judge on matters of fact in dispute between the parties, but only on condition of disclosure and a right of response sufficient to comply with the requirements of natural justice.

[68] See *Supreme Court Act 1981* (U.K.), ss. 54, 76, and *Civil Procedure Rules* r. 35.15. See also *Halliburton Energy Services Inc. v. Smith International (North Sea) Ltd.*, [2006] EWCA Civ. 1599 (Eng. C.A.), citing in part the *Porto Seguro* decision from our Supreme Court (at paras. 18-20).

[69] See Rule 3 of Order 34A of the Australian *Federal Court Rules*.

Appeal courts should be prepared to consider rejection of boilerplate reasons from a trial judge that fail to come to grips with the scientific debate underlying the issues being litigated.[70]

CONCLUSION

Despite the conciliatory (if somewhat superior) tone adopted by the English judge over four hundred and fifty years ago ("we do not despise all other sciences but our own, but we approve of them and encourage them..."[71]), it must be said that judicial progress in matching reality to these fine words has been slow. Our courts may approve and encourage other sciences, but the real question is whether or not we adequately understand the science; and if not, are we doing enough to make our courts more "science friendly"? Procedures designed to deal with garden variety legal disputes have often been found inadequate, if not actually counter-productive, with respect to cases involving science and technology. The legitimacy of a court's judgment in such cases is tied to the rigour of its fact-finding and the ability of the judge or juror to evaluate the expertise involved. Reforms have been implemented, but more needs to be done if we are to be ready when Schroedinger's cat arrives on the courthouse steps.

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[70] This approach is consistent with what the Supreme Court has set out in *R. v. Sheppard*, [2002] 1 S.C.R. 869 and *R. v. Braich*, [2002] 1 S.C.R. 903, for determining the adequacy of reasons for appellate review. The principle is that the reasons must be sufficient for an appellate court to determine the correctness of the trial decision.

[71] *Buckley*, *supra* note 1.