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Scientific Evidence in Europe — Admissibility, Evaluation and Equality of Arms

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Christophe Champod and Joëlle Vuille

Abstract

This study was commissioned by the European Committee on Crime Problems at the Council of Europe to describe and discuss the standards used to asses the admissibility and appraisal of scientific evidence in various member countries. After documenting cases in which faulty forensic evidence seems to have played a critical role, the authors describe the legal foundations of the issues of admissibility and assessment of the probative value in the field of scientific evidence, contrasting criminal justice systems of accusatorial and inquisitorial tradition and the various risks that they pose in terms of equality of arms. Special attention is given to communication issues between lawyers and scientific experts. The authors eventually investigate possible ways of improving the system. Among these mechanisms, emphasis is put on the adoption of a common terminology for expressing the weight of evidence. It is also proposed to adopt an harmonized interpretation framework among forensic experts rooted in good practices of logical inference.

The foreword was authored by D. Michael Risinger, *Seton Hall University School of Law*.

Author Notes: Comparative study on scientific evidence drawn up for the Bureau of the Council of Europe's European Committee on Crime Problems (CDPC). The authors would like to thank Prof. Pierre Margot for his helpful comments and the translators from the Council of Europe for translating a report originally written in French.

FOREWORD

For both practitioners and academics, it is difficult but important to avoid insularity and parochialism in most areas of legal practice. It is difficult because practical considerations tend to focus us on local, or at most, national practices. It is important because knowledge of how other developed legal cultures[1] deal with particular issues can inform our own view of the possibilities for improvements in our own system. Forensic science is a good example both of the tendency toward insularity, and of the insights that can be gained by knowledge of approaches in other cultures.

I am not suggesting searching out the truly exotic. Forensic practices in North Korea are unlikely to have much to offer of interest or value, especially given the efforts needed to discover their contours. The English speaking world offers many important contrasts and potential lessons. For instance, there is much be learned from the Canadian practice of conducting detailed "autopsies" on prominent miscarriages of justice, including those involving miscarried forensic science.[2] And of course, in 2009 the National Research Council (NRC) of the American National Academy of Science (NAS) issued its report which contained much that might be of value to those in other countries.[3] Moreover later in 2009 the Law Commission (UK) issued a report on forensic science and the courts[4] which was in some ways an informative contrast with the American NAS/NRC Report. This journal published an article giving one view of the contrast, in order to bring both reports to the attention of readers on both sides of the Atlantic, and elsewhere.[5]

However, penetrating the realities of practice in Europe is a more difficult task, given the number of jurisdictions and the resulting language barriers involved. With that in mind, we are fortunate to be able to present in English

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[1] At least those generally conceded to be functioning representatives of the rule of law.

[2] See, e.g., the Report of the Kaufmann Commission on Proceedings involving Guy Paul Morin, Ministry of the Attorney General, Ontario (Toronto, 1998).

[3] NATIONAL RESEARCH COUNCIL, NATIONAL ACADEMY OF SCIENCES, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (2009). This Report is sometimes referred to as the NAS Report and sometimes as the NRC Report in the literature. For a full account of the rather Byzantine organization of the National Academy of Sciences, and its equally Byzantine relationship with Congressional directives, and the difficulties these things create in arriving at a single authoritative characterization for this report, see D. Michael Risinger, *The NAS/NRC Report on Forensic Science: A Path Forward Fraught with Pitfalls*, 2010 Utah L. Rev. 225, fn. 1 (2010).

[4] The Law Commission "The Admissibility of Expert Evidence in Criminal Proceedings in England and Wales: A New Approach to the Determination of Evidentiary Reliability" (2009) Consultation Paper 190.

[5] Rhonda M. Wheate & Alan Jamieson, *A Tale of Two Approaches—The NAS Report and the Law Revision Consultation Paper on Forensic Science*, 7 Int. Comm. On Evidence, Issue 2, art. 3 (2009).

translation a report commissioned by the Council of Europe on the state of forensic practice both globally and in the European Union (with recommendations for improvement), entitled *Scientific Evidence in Europe—Admissibility, Evaluation and Equality of Arms*.[6] The authors are Dr. Christophe Champod, Professor on the faculty of Law and Criminal Science in the University of Lausanne, Switzerland, and Joelle Vuille, Research Assistant in the same institution. Professor Champod and Ms. Vuille do a fine job of surveying the current status of forensic science in both various English speaking jurisdictions and in the European Union, and the legal principles which control its utilization in criminal cases (indeed, their report functions as a sort of introductory one-stop shop for those interested in expanding their knowledge of these various approaches). They then turn their attention to a variety of recommendations for improved practice within the EU.

Of course, it is in the nature of such a report that it will necessarily encompass a view from 30,000 feet, and those intimately familiar with one or another of the jurisdictions surveyed may find themselves quibbling with this or that detail of the description set out. For instance, an American reader might find that the Champod/Vuille Report's account of the *Frye* test did not capture either the effulgent variety of approaches that go by that name, or the besetting problems of such approaches when it comes to addressing the requirement of "novelty," to defining what constitutes "general acceptance" or to selecting the set of "scientific experts" by reference to which the issue of general acceptance is to be determined. But such objections would be misplaced to a great degree. The Report is necessarily a vade mecum, not a complete treatise.

Also, of course, there is room to disagree with some of the positions taken in the Report, or at least with their apparent emphasis. For instance, the authors' position on the need for "context" information in the proper performance of forensic examinations[7] comes perilously close to crossing the line separating a forensic expert from an all purpose Sherlock Holmes figure.[8] However, with only a moderate adjustment the authors' position can become consistent with

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[6] Christophe Champod and Joelle Vuille, *Scientific Evidence in Europe—Admissibility, Evaluation and Equality of Arms* (a report to the Council of Europe, originally produced 2010) (Hereinafter "the Champod/Vuille Report").

[7] See Champod / Vuille Report, infra, at fn 174-fn 180.

[8] On the dangers of letting forensic experts go beyond the strict limits of their expertise to become general detectives, *see* D. Michael Risinger, Michael J. Saks, William C. Thompson & Robert Rosenthal, *The* Daubert/Kumho *Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion*, 90 CAL. L. REV. 1, 27-30 (2002). On the dangers inherent in the Sherlock Holmes model of heroic positivist detection, *see* D. Michael Risinger, *Boxes in Boxes: Julian Barnes, Conan Doyle, Sherlock Holmes and the Edalji Case*, 4 INT'L COMMENT. ON EVIDENCE, issue 2, article 3 (Dec. 2006), at 6-9, *available at*

"sequential unmasking" models being called for by some of us in the United States, because such an approach provides all needed context, but insulates the bench examiner doing the tests and initial characterizations from everything but the information necessary to that function, given in the order least likely to distort the results through observer bias.[9]

Beyond that, the authors' affection for likelihood ratios as the means for expressing expert conclusions is understandable, given the fact that Professor Champod is a prominent early exponent of such an approach,[10] and also a member of a group that has pioneered a brilliant method for extracting data from fingerprints that can generate empirically justified likelihood ratios for the truly binary competing propositions: "suspect was the source of the fingermark (latent print)" versus "some other human was the source of the fingermark (latent print).[11] However, I for one remain suspicious of a generalized likelihood ratio approach to communicating the meaning of much expert information, especially if experts are given the kind of interpretational role in regard to party theories that the Champod/Vuille Report seems to envision. In a criminal case, at least in the United States, the defense has no obligation to put forth any specific theory, and the characterization of the second hypothesis in a likelihood ratio as the "defense theory" in the case can be problematic and misleading. In addition, while likelihood ratios can in theory be used to express the relative support of a given piece of evidence for any two hypotheses accounting for it, likelihood ratios are least problematic and least subject to misinterpretation in regard to true binaries, and true binaries can be slippery and difficult to formulate in the context of the

[9] *See* Risinger et al, supra note 8, at, 45-47; Dan E. Krane et al., , *Sequential Unmasking: A Means of Minimizing Observer Effects in Forensic DNA Interpretation*, (Letter/Commentary) 53 J. FORENSIC SCI. 1006, 1006 (2008). Dan E. Krane et al., *Response to Wells*, 54 J. FORENSIC SCI. 501 (2009); Dan E. Krane et al., *Response to Ostrum*, 54 J. FORENSIC SCI. 1500 (2009); Dan E. Krane et al., *Commentary on Budowle et al*, 55 J. FORENSIC SCI. 273 (2009); William C. Thompson et. al., *Response to Thornton*, 65 J. Forensic Sci. 1663. Mnookin et al, *The Need for A Research Culture in the Forensic Sciences*, 58 U.C.L.A. L. Rev. 725, 770-771(2011).

[10] *See* Evett, I., Gill, P.D., Jackson, G., Whitaker, J. and Champod, C., *Interpreting small quantities of DNA: the hierarchy of propositions and the use of Bayesian networks*, 47 J. Forensic Sci. 520 (2002); Jackson, G., Jones, S., Booth, G., Champod, C., and Evett, I., The nature of the forensic science opinion—a possible framework to guide thinking and practicein investigations and court proceedings, 46 Sci. & J. 33 (2006).

[11] *See* Neumann, C., C. Champod, R. Puch-Solis, D. Meuwly, N. Egli, and A. Anthonioz (2006). *Computation of likelihood ratios in fingerprint identification for configurations of three minutiae*, 51.J. Forensic Sci. 1255 (2006); Neumann, C., C. Champod, R. Puch-Solis, N. Egli, A. Anthonioz, and A. Bromage-Griffiths, *Computation of likelihood ratios in fingerprint identification for configurations of any number of minutiae.* 52 Journal of Forensic Sciences 54 (2007); Neumann, C., I.W. Evett and J. Skerrett, *Quantifying the Weight of Evidence Assigned to a Forensic Fingerprint Comparison—A New Paradigm,* Proceedings of the Royal Statistical Society, anticipated publication, 2011 (copy on file with author).

complexities of many criminal cases if one strays far from the simple negation of the presecution's hypothesis. Finally, properly warranted sources of data to give properly warranted values to likelihood ratios are simply unavailable in regard to many propositions of interest, and falling back on the experience of the examiner to generate them is a questionable practice at best, in my opinion.[12]

Be all this as it may be, it hardly detracts from the importance and usefulness of this Report, both for its originally intended audience in the Council of Europe, and for the more extended audience it will now have in the greater international legal community by virtue of its publication here.

Finally, one term in the title of the report perhaps could do with some preliminary explanation. The notion of "equality of arms" is actually drawn from decisions of the European Court of Human Rights, and despite its rather martial imagery, might better be described as "equality of resources" between the prosecution and defense, as far as access to forensic evidence is concerned. The problems of unequal resources available to defense and prosecution is a recurring theme in American writings on forensic science, and it is quite informative to see how the same problem is addressed in Europe. Whether the problem is addressed more effectively I leave to the reader of the Champod/Vuille Report.

Michael Risinger

[12] Such considerations apparently lie behind the recent decision of the High Court of Justice, Court of Appeal, Criminal Division in R. v. T., [2010] EWCA Crim. 2439 (Dec. 26, 2010). Whether that opinion is too restrictive in forbidding use of a likelihood ratio approach as an aid to the forensic expert's formulation of his or her own conclusion is a question for another day.

Scientific Evidence in Europe – Admissibility, Evaluation and Equality of Arms

Christophe Champod and Joëlle Vuille

1. Introduction

The purpose of this report is to assess the use of scientific evidence in criminal proceedings in Europe, to describe how such evidence is currently interpreted and appraised, and to study the impact of this evidence in terms of the principle of equality of arms. Criminal justice is making increasing use of scientific evidence[13], which is becoming increasingly complex. At the same time, lawyers and citizens called upon to assess scientific evidence still lack the necessary training, and are generally unfamiliar with how scientific techniques are developed and the implications of these techniques for the nature of the knowledge produced[14]. Famous cases that highlight occasional major dysfunctions in the laboratories working with the justice system, and exaggerated interpretations of analytical findings, sometimes prompt questions about the scientific nature of certain forensic fields.

Our presentation will start with a brief recapitulation of recent criticisms of various forensic disciplines in Europe and the United States, to retrace the genesis of the recent report of the US National Research Council (2009) and the recommendations of the Law Commission (2009) in England and Wales. While reviewing that situation, we will also emphasise the difficulty of formulating solutions on the basis of anecdotal cases. We will then outline the advantages and disadvantages generally ascribed to the accusatorial and inquisitorial systems with respect to the use of scientific evidence. That will enable us to move on to a discussion of the principle of equality of arms and the specific risks which these two main procedural systems present from the perspective of equality of arms. From there, we turn to a comparative analysis of the legislative options that European and North American countries chose to govern decision about whether to employ scientific evidence. No matter what legislative choices are made however, scientific evidence cannot be incorporated into fact-finding without appraisal of the evidence, implicit or explicit. One section of this report will

[13] The word "evidence" is used as a generic term in this document. Strictly speaking, from a scientific standpoint, facts supported by means of forensic techniques constitute information or leads for the investigation and become evidence once the decision-maker (judge or jury) recognises its probative value in relation to the legal issue raised.

[14] See Redmayne (1997, pp. 1028-1035).

therefore focus on the difficulties of interpretation and appraisal. Finally, we suggest some ways to facilitate fact-finders' evaluation of scientific evidence in judicial proceedings. Several of our suggestions address the interactions of forensic scientists and lawyers, and so may be implemented regardless of the general procedural system (accusatorial or inquisitorial) in a particular state.

2. Case literature

The increased use of DNA testing in criminal prosecutions in the 1990's had an unexpected side-effect: DNA testing's promoters had sold it as a fantastic tool for identifying perpetrators. In practice, though, it not only identified or ruled out actual and prospective defendants as perpetrators at or before trial, but also offered a "safe" standard for judicial accuracy against which methods of investigation and judicial processes could be measured by examining the cases of persons already convicted.

The Innocence Project[15], for example—which used DNA testing to exonerate a large number of people serving long prison sentences, highlighted dramatic weaknesses in certain traditional types of evidence (witness evidence, confessions, etc.), and delineated the problematical effects of occasional faulty use of scientific evidence.

A body of literature has therefore grown up over the last few years criticising errors, intentional or not, in the use of scientific evidence. But what is the scale of the phenomenon? What forensic disciplines are most affected by flaws in theory or practice? And how much credence should really be lent to publications adopting what is often a very alarmist tone?

A few years ago, Donald Kennedy (2003), editor of the prestigious journal *Science* , posed a thought-provoking question: is the combination of the words "science" and "forensic" not an oxymoron? In support of this, he noted a blatant discrepancy between scientific standards in the field of forensic genetics and the lack of structured research and standards as to the reliability of other forensic techniques (such as fingerprinting). The question of the existence of scientific standards in forensic science persists, as may be seen from the recent report by the American National Research Council (2009) (hereinafter: NRC), which describes an alarming situation in the majority of forensic sections in American laboratories, the only field to stand up to scientific scrutiny being that of forensic genetics. We propose to conduct a realistic review of the situation later in this

[15] The Innocence Project is conducted at the Cardozo Law School (Yeshiva University, New York, United States) by the lawyers Barry Scheck and Peter Neufeld. Its efforts, along with others, have so far made it possible to prove the innocence of 273 wrongly convicted persons, including 17 sentenced to death (numbers as of September 7, 2011).

paper, while emphasising the difficulty of formulating solutions solely on the basis of anecdotal cases.

The forensic sciences are not infallible, as three distinct types of research point out. Research in the first category typically uses as its point of departure cases in which questionable use of scientific evidence potentially contributed to a miscarriage of justice. That research may also consider published results of performance tests obtained by the forensic laboratories. The second category bases its criticisms on results of the introduction of DNA profiling techniques in investigation. Finally, the third category approaches the situation from the perspective of changes in the rules of admissibility in the United States initiated in 1993 (*Daubert*[16], *Kuhmo Tire*[17] and *Joiner*[18] cases, departing from the approach of the 1923 *Frye*[19] decision).

2.1. Performance tests

The first collaborative programmes to test forensic laboratories were established in the United States in the 1970's under the aegis of the LEAA (Law Enforcement Assistance Administration). The alarming results of these assessments did not escape the notice of the judicial community. Several publications have since called on parties to adopt a critical, or indeed aggressive, attitude when prosecutors introduce technical evidence. The seminal work here is Imwinkelried's (1981, 1992). More recently, the excellent Modern Scientific Evidence (Faigman *et al.*, 2007) has become the indispensable source book for judges.

There is no doubt that the results of controlled-situation tests have demonstrated the importance of regulation of laboratory procedures. Jonakait (1991) observed not only that there could be loopholes in procedures, but, furthermore, that training and research, mainly in the traditional forensic science fields, were non-existent. The NRC (2009) reached the same conclusion concerning a crucial need for regulation two year ago.[20] The situation has not improved since Jonakait wrote, because of the rapid increase in the number of scientific techniques available to courts. Training for judges in these newly-developed fields has become indispensable to avoid a context in which they would be required to accept the findings of scientific experts as an *ipse dixit.* That

[16] *Daubert v. Merrell Dow Pharmaceuticals Inc.*, 113 S. Ct. 2786 (1993).
[17] *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).
[18] *General Electric v. Joiner* 522 U.S. 136 (1997).
[19] *Frye v. United States* 293 F 1013 (D.C. Cir. 1923).
[20] This report has been the subject of intense discussion and debate both in specialist journals and in some major scientific journals such as *Nature.* See, e.g., Editorial, (2010) ; Gilbert, 2010, Neufeld & Scheck, 2010 ; Spinney, 2010).

situation has its roots in the earlier parts of the twentieth century, in which the task of evaluating the admissibility of scientific evidence lay, for practical purposes, with the expert, despite formal legal standards allocating it to the judge. The *Frye* decision established a demarcation line between acceptable and unacceptable science based on recognition of the scientific field in question by the scientific community concerned. *Frye* thus established a more restrictive principle than the liberal criterion Federal Rule of Evidence 702 adopted in 1975. The lack of very specific criteria in the early version of FRE 702 made it an extremely flexible rule, opening courtrooms to techniques that relevant scientific communities did not recognize, and which had not yet stood the test of time (Huber, 1990).

However, with the last decades of the twentieth century came an explosion in legal arguments for the use of technical methods in trials. Scientists and lawyers contended that *Frye* was too selective and vague, preventing or limiting prosecutorial use of certain advanced techniques because those techniques had not yet obtained the seal of approval of the relevant scientific community concerned (Giannelli, 1980). In this connection, Huber (1991a) pointed out the danger that some techniques dismissed as "junk science" might be admitted into civil trials. Giannelli (1993) noted at around the same time the lack of any real opportunities for criminal defendants to develop their own expert scientific evidence, and the degree to which the lack of any requirement that the prosecution disclose supporting documents limited defense opportunities to dispute such evidence offered by the prosecution.

2.2. The advent of DNA profiling

The introduction of DNA profiling in courtrooms was gradual and was accompanied by heated debate, mainly in the English-speaking countries,[21] which was eventually settled by two reports by the American NRC (1992, 1996). This intense debate – fuelled by certain high-profile cases (Giannelli, 1997) – undoubtedly prompted thinking about analytical procedures and their accreditation, disclosure practices, defence access to expert resources and the need for independent studies. Following publication of the second NRC report (1996), controversy over the admissibility of evidence based on forensic genetics died down, to the point that DNA testing has become the new standard against which the accuracy of forensic techniques is measured (Lynch, 2003).

In the process, DNA testing has brought to light judicial errors, especially under the auspices of the Innocence Project in the United States. Genetic evidence

[21] See for example (Thompson & Ford, 1990; Thompson, 1993).

has made it possible to exonerate over 200 people, including some on death row (Gross, 2008).

The use of forensic genetics in the courts is still giving rise to criticism in publications (Thompson, 2006) highlighting serious errors committed in certain laboratories (in Houston, for example). The points which are still under debate, and have been since the 1990s (Thompson, 1993, 1995) despite technological advances, include :

- decision-making criteria regarding allele designation in genetic profiles (without judgment being influenced by a knowledge of the known profiles in the file) (Krane *et al.*, 2008; Thompson, 2009b) ;
- estimation of the risk of laboratory error and its inclusion in quantified assessment of results (Koehler, 1997; Thompson *et al.*, 2003) ;
- statistical interpretation of DNA mixtures[22], also discussed by the UK Court of Appeal[23];
- the use of ultrasensitive techniques as in the recently tried Omagh Bombing case[24] or the *Reed, Reed & Garmson* case[25] ;
- issues relating to the transfer and persistence of biological fluids, as in the *Weller*[26] or *Reed & Reed*[27] cases[28].

The dialectic between scientists and commentators is therefore constructive, encouraging transparency and recognition of the fact that contamination exists and must be controlled through appropriate quality assurance procedures. Finally, it is sufficient to bear in mind that, however technologically advanced the tests may be, they are performed by human beings who are not infallible and that errors can occur despite the existence of a safety net with a very fine mesh due to all the protocols that have been put in place (Imwinkelried, 1991).

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[22] See in particular (Gill *et al.*, 2006; Morling *et al.*, 2007; Gill *et al.*, 2008; Balding & Buckleton, 2009; Stringer *et al.*, 2009).

[23] *R. v. Richard Bates*, UK Court of Appeal, [2006] EWCA Crim 1395.

[24] *The Queen v. Sean Hoey* [2007] NICC 49. See also (Caddy *et al.*, 2008; McCartney, 2008a, 2008b; Budowle *et al.*, 2009; Gill & Buckleton, 2009).

[25] *R. v. David Reed and Terence Reed, R. v. Neil Garmson*, UK Court of Appeal, [2009] EWCA Crim 2698.

[26] *R. v. Peter Weller*, UK Court of Appeal, [2010] EWCA Crim 1085.

[27] *R. v. David Reed and Terence Reed, R. v. Neil Garmson*, UK Court of Appeal, [2009] EWCA Crim 2698.

[28] The type of question raised no longer being: "Whose is the DNA found on his fingers?", but "As a result of what activities did this DNA end up on his fingers?".

2.3. New admissibility criteria established by the United States Supreme Court

The third category is comprised of cases establishing the radical new approach that the US Supreme Court first employed in the *Daubert* decision. By establishing specific criteria[29] (going beyond "general acceptance" of the much earlier the *Frye* decision) all of which the judge must consider in assessing the admissibility of scientific evidence, the Court implicitly encouraged lawyers and scientists to take a fresh look at all the forensic sciences (even the least controversial). Commentators made the implicit encouragement explicit. .[30]. As Jonakait put it (1993-1994, p. 2117) : "If *Daubert* is taken seriously, then much of forensic science is in serious trouble". From the issuance of *Daubert,* onwards, more and more articles called for approach more in line with the *Daubert*'s scientific criteria in such fields as handwriting and signature analysis[31], fingerprints[32], firearms and tool marks[33], and bite marks[34].

In each of these disciplines, there was also a call to refrain from testifying to absolute scientific conclusions often based on the vague concept of individualisation or uniqueness[35], in favour of more modest conclusions recognising the sometimes imperfect performances measured in these disciplines. Although Collaborative Testing Services (one of the leader in production and management of quality tests in forensic science) recently stressed that the error rates obtained in the performance tests it administers are not a good indicator of the error rate associated with the disciplines concerned (Collaborative Testing Services Inc., 2010), Koehler (2008) recommends using these results (following appropriate analysis) to help ensure that technical evidence is used in a fully informed way. The culmination of this criticism was perhaps the call by Saks and Koehler (2005) for a change of paradigm to ensure that the rigour and transparency associated with forensic genetics were adopted in all other fields of

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[29] Check (a) whether the theory or technique has been tested; (b) whether it has been subjected to peer review and publication; (c) whether the potential error rates associated with the method are known; (d) whether the technique is subject to standardised procedures and quality controls; (e) whether the technique is accepted by the scientific community concerned.

[30] See in particular (Jonakait, 1991; Saks & Koehler, 1991; Faigman *et al.*, 1994; Saks, 1998; Risinger & Saks, 2003).

[31] (Risinger *et al.*, 1989; Risinger & Saks, 1996; Mnookin, 2001b).

[32] (Cole, 2000, 2001; Mnookin, 2001a; Epstein, 2002; Imwinkelried, 2002; Sombat, 2002; Cole, 2003; Lawson, 2003; Mnookin, 2003; Saks, 2003; Benedict, 2004; Cole, 2004a, 2004b; Steele, 2004; Cole, 2005a; Schwinghammer, 2005; Zabell, 2005; Cole, 2006a; Meintjes-van der Walt, 2006; Cole, 2007; Haber & Haber, 2008; Mnookin, 2008; Haber & Haber, 2009).

[33] (Steele, 2002 ; Schwartz, 2004, 2005; Nichols, 2007; Schwartz, 2007).

[34] (Pretty & Sweet, 2001; Kieser, 2005; Bowers, 2006).

[35] See in this connection (McLachlan, 1995; Saks & Koehler, 2008; Champod, 2009; Cole, 2009; Kaye, 2009a; Kaye, 2010).

forensic science. These conclusions were eventually incorporated into the latest NRC report (2009).

2.4. "Causes célèbres" in the different areas of forensic science

A series of "causes célèbres" have fuelled this move towards an increased scrutiny of forensic science practices. Some illustrations of the problems encountered in several forensic fields:

Biological traces: A case preceding the use of forensic DNA analysis is that of Lindy and Michael Chamberlain in Australia, who were convicted of murder on the basis of a faulty interpretation of blood stains in their car and tears in their child's clothing (Morling, 1987). This case contributed to the founding of the National Institute of Forensic Science[36] in Australia, as did the *Pratt* case, which involved highly questionable use of microtraces (paint, fragments, etc.) (Shannon, 1984). The *Preece* case[37] in Scotland brought out the need for rules of disclosure in relation to technical evidence. In this case, the expert (Dr Clift) omitted to mention the results of serological analyses on the victim's body fluids. These results put into perspective the positive results obtained for Preece.

The use of DNA evidence did not eliminate such errors, as shown by Fred Zain's deliberate falsification of DNA evidence (Giannelli, 2005) and by the recent practices of several American laboratories, including the one in Houston, making little use of accredited protocols (Giannelli, 2007; Thompson, 2008).

Bite marks: The *Krone* case (Bowers, 1996; Anonymous, 2002) and the *Brooks* and *Brewer* cases[38], handled by the highly controversial Dr West, are perfect examples of exaggeration in the interpretation of technical evidence, lending it an associative strength going far beyond what is scientifically acceptable.

Finger marks: Over 20 cases of wrong associations were documented by Cole (Cole, 2005b, 2006b). The recent Mayfield case, in which a mark detected during the investigation of the Madrid bomb attacks in 2004 was wrongly matched up to him by three FBI experts and an independent expert, has

[36] http://www.nifs.com.au/
[37] *Preece v H.M. Advocate* [1981] Crim.L.R. 783.
[38] http://abcnews.go.com/TheLaw/story?id=4311309&page=1

been the subject of several published inquiries[39]. Cole says that this is possibly only the tip of the iceberg.

The Mayfield case also serves to highlight the risks posed by cognitive bias, which may, on several levels, taint the decisions taken by a forensic expert[40]. The report by the Office of the Inspector General (2006) states that the repetition of the four errors can be partly accounted for by the fact that the three experts who conducted their comparative examinations after the first expert were perfectly aware of the latter's final conclusion. Cognitive bias would therefore seem to have contributed to misidentification in this case. The lack of a mechanism for reducing context effects on operators was also identified in the NRC report (2009) as a major source of concern, especially in fields (such as fingerprinting or handwriting and signature analysis) with a large comparative component left entirely to an expert's judgment[41].

Comparative hair analysis: Many cases of dubious associations have been highlighted in the Innocence Project (Giannelli, 2002). The Guy Paul Morin case discussed below is also significant in this respect.

Comparative fibre analysis: Among other factors, evidence based on comparative analysis of fibres (fibres found on the victim matching the carpet in the suspect's car) and of hair played a significant part in the conviction of Guy Paul Morin in Canada. Morin was acquitted by the Ontario Court of Appeal after DNA analysis had shown that the traces of sperm found on the murdered child's underwear could not be his. A public inquiry headed by Kaufman revealed major shortcomings in laboratory work and interaction between experts, police and judges with regard to hair and fibre evidence (Kaufman, 1998). As regards specifically the results of comparative hair analysis, the report by the committee of inquiry notes that the use by experts of vague conclusions such as "the hair might come from…", "the fibres are consistent with…" or "the fibres match", which lend themselves to a range of interpretations, was one of the causes leading to the attribution of

[39] The reports connected with the Mayfield case are as follows: (Stacey, 2004; Smrz *et al.*, 2006; United States Department of Justice & Office of the Inspector General - Oversight and Review Division, 2006; United States Department of Justice & Office of the Inspector General - Oversight and Review Division, 2011).

[40] On cognitive risks, see Dror (2009), Thompson (2009a) and Dror & Cole (2010) and the relevant references.

[41] The field of forensic genetics is not immune to the risk of cognitive bias (Thompson, 1995; Krane *et al.*, 2008), but the problem is less salient that in the more traditional areas of forensic science.

disproportionate probative value to evidence which actually made only a limited contribution to the establishment of the facts. Where fibres are concerned, in addition to the fact that the experts provided both the inquiry and the trial court with flawed information, serious problems of contamination were brought to light. Even more seriously, subsequent technical evidence supporting the defence's line of argument was, conveniently, not disclosed.

Comparative bullet lead analysis: Following the doubts voiced by Tobin (a former FBI specialist) about the technique used (Imwinkelried & Tobin, 2003; Tobin, 2004), an investigation conducted by a committee of the NRC (National Research Council - Committee on Scientific Assessment of Bullet Lead Elemental Composition Comparison, 2004) and a debate in the specialist literature[42], the technique used routinely by the FBI was quite simply abandoned owing to the lack of an adequate validation procedure.

Fire investigation: The Willingham case (Grann, 2009), still under investigation in Texas, offers some alarming indicators regarding the quality of the techniques used during the investigation.

Explosive residue analysis (Schurr, 1993): The Judith Ward[43], Birmingham Six[44] and Maguire Seven[45] cases in the United Kingdom are emblematic of the errors committed in the 1970s in analysis of explosive residues - and specifically, in all these cases, nitro-glycerine: an expert whose competence was disputed (Dr Skuse), experts lacking objectivity and failing in their duty of transparency (Mr Elliott & Mr Higgs), unspecific method of characterisation, contamination of samples, lack of declared and standardised protocols, lack of disclosure.

The Maguire Seven case was the subject of a public inquiry (May Inquiry), which was subsequently transformed into the Royal Commission on Criminal Justice (Runciman Report (1993)). The findings led to substantial changes in the rules of disclosure, the setting up of a forensic service independent of the prosecuting authorities (now the Forensic Science Service Ltd) and the setting up of the Criminal Cases Review Commission (CCRC) and its Scottish counterpart, the SCCRC (Nobles & Schiff, 2001).

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[42] See the following articles: (Finkelstein & Levin, 2005; Thompson, 2005; Kaye, 2006; Kaasa *et al.*, 2007).

[43] *R v Ward* (1993) 96 Cr. App. R. 1.

[44] *R. v. McIlkenny* (1991), 93 Cr. App. R. 287 (C.A.).

[45] *R. v. Maguire & Ors.* (1992), 94 Cr. App. R. 133.

Ear mark analysis: In the Dallagher[46] and Kempster[47] cases, ear marks (found at the crime scene) were used as the only means of identifying the two suspects. In both cases, the Court of Appeal, without stating that the technical evidence was inadmissible under UK case-law, nevertheless urged caution in assessing its associative strength. The subsequent DNA analysis in the Dallagher case (the DNA profile obtained from the ear print did not match Dallagher's) certainly played a large part in the authorities' decision to discontinue the proceedings. But it would be wrong to see the results of this analysis as incontrovertible proof of Dallagher's innocence[48].

Comparative analysis of body odours by dogs: The technique of training dogs to recognise individuals (in identity parades) on the basis of odour samples taken at the crime scene is used in a number of European countries, notably in Poland, France and the Netherlands. The increased use of these techniques by credible bodies might lead one to believe that the results (positive or negative) have very great probative force. Nevertheless, several commentators advise caution[49].

Submission of a statistical argument to the court: Meintjes-van der Walt (2001, p. 166) gives a perfect summing-up of the issues involved: "The problem surrounding experts expressing probabilities in such a way that they trespass on the ultimate issue is however an issue that decision-makers should give careful consideration to when evaluating such evidence". The proper presentation of a statistical argument, such as, for example, the probabilities associated with the results of a comparison of genetic profiles, is not an easy matter, from both the expert's and the court's point of view. The UK Court of Appeal gave some guidelines following the Deen case and especially the

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R. v. Mark Dallagher, UK Court of Appeal - Criminal Division, [2002] EWCA Crim 1903.

[46] *R. v. Mark J. Kempster*, UK Court of Appeal - Criminal Division, [2003] EWCA Crim 3555. *R. v. Mark J. Kempster*, UK Court of Appeal - Criminal Division, [2008] EWCA Crim 975.

[46] See in this connection the article by Schiffer & Champod (2008).

[46] Refer to the following articles: (Broeders, 2006; Tomaszewski & Girdwoyn, 2006; Wojcikiewicz, 2009).

[46] *R v Alan James Doheny, R v Gary Adams*, UK Court of Appeal - Criminal Division, [1996] EWCA Crim 728.

[46] The following two articles provide a detailed explanation of this error of reasoning; Balding et Donnelly (1994) et Leung (2002).[46] *R. v. Mark Dallagher*, UK Court of Appeal - Criminal Division, [2002] EWCA Crim 1903.

[47] *R. v. Mark J. Kempster*, UK Court of Appeal - Criminal Division, [2003] EWCA Crim 3555. *R. v. Mark J. Kempster*, UK Court of Appeal - Criminal Division, [2008] EWCA Crim 975.

[48] See in this connection the article by Schiffer & Champod (2008).

[49] Refer to the following articles: (Broeders, 2006; Tomaszewski & Girdwoyn, 2006; Wojcikiewicz, 2009).

Doheny & Adams cases[50]. Forensic genetics experts are urged to take account of these recommendations and to avoid falling into the now clearly identified but, unfortunately, still common trap of the "prosecutor's fallacy" or the "inversion fallacy"[51]. The US Supreme Court, ruling in the McDaniel et al. v. Brown case[52], recently acknowledged the danger of this error, which leads to overestimation of the real significance of technical evidence (Kaye, 2009b). The Keir case[53] in Australia is another good example of this. The situation is by no means clarified in the other countries, leaving ample scope for error. This is a major source of concern, which is manifest in all cases where the statistical argument carries significant weight. Recent cases in which experts were called upon to express an opinion on the probability of occurrence of multiple sudden infant deaths (eg the Sally Clark[54] or Angela Cannings[55] cases in the United Kingdom) have shown once again how essential it is for the court to be able to assess figures without committing syllogistic errors that can result in undue importance being attached to the statistical argument. A similar situation arose in the case of Lucia de Berk in the Netherlands, resulting in an acquittal in April 2010 (Lucy, 2006; Meester *et al.*, 2006).

2.5. Forensic science as a source of judicial error?

The above-mentioned British and American cases (Giannelli, 2007; Garrett & Neufeld, 2009) and Canadian cases (MacFarlane, 2006) are regularly cited, along with other incidents, in the literature on judicial errors. All the studies on this subject reflect ambivalent feelings with regard to expert scientific opinion.

On the one hand, the forensic sciences have been identified as a leading cause in the error process. Obvious shortcomings are generally noticeable with regard to training, the quality of scientific protocols or assessment of the actual significance of technical evidence. The catalogue of causes, involving technical elements to varying degrees, has alarmed a number of observers. However, the

[50] *R v Alan James Doheny, R v Gary Adams*, UK Court of Appeal - Criminal Division, [1996] EWCA Crim 728.

[51] The following two articles provide a detailed explanation of this error of reasoning; Balding et Donnelly (1994) et Leung (2002).

[52] *McDaniel, Warden, et al. v. Troy Brown*, Supreme Court of the United States, 558 U.S. (2010).

[53] *R. v Keir*, Supreme Court of New South Wales (Court of Criminal Appeal), CCA 60092/00 SC 70049/98.

[54] *R v Sally Clark*, UK Court of Appeal - Criminal Division, [2003] EWCA Crim 1020. The case is well described in (Johnson, 2004; Nobles & Schiff, 2005).

[55] *R v Angela Cannings*, UK Court of Appeal - Criminal Division, [2004] EWCA Crim 1.

number of such cases[56] should be kept in perspective and viewed in relation to all the other criminal or civil cases deriving benefit from the forensic sciences.

On the other, the forensic sciences have been instrumental in discovering judicial errors. Advances in DNA testing have much to do with this[57]. These technical advances have led to changes in the rules in the United States, enabling sentenced persons to apply for their cases to be reopened.

Before we go further with our analysis, however, it should be noted, as Edmond (2002) has already done, that analysis of scientific contributions as a cause of judicial error has been essentially asymmetrical in that it has shown greater severity in examining evidence against the defendant, in order to highlight any weaknesses in it, and has been generous in admitting exonerating evidence, displaying little rigour in testing its reliability and, consequently, (relatively) easily accepting the person's innocence. Now, while the asymmetry of this reasoning may be justified from a legal point of view - a position which we do not endorse[58] - because the evidentiary requirements are themselves unequal in criminal cases[59] it is indefensible from a scientific standpoint. Consequently, as Thompson (2008) points out, everyone in the criminal-law system has found it very reassuring to be able to lay the blame on a few black sheep and to propose individual actions rather than undertake a systematic analysis focusing not solely on individuals, but on the system in its entirety. Schiffer (2009) reaches the same conclusion.

Modern scientific techniques bring unquestionable benefits to the judicial system, but these techniques must be employed in an appropriate scientific and legal framework. The report by Canadian prosecutors revisits a number of judicial errors and restates some self-evident proposals for the forensic sciences (Heads of Prosecutions Committee Working Group, 2004): the need for courts to properly assess the role of experts and not allow them to usurp their decision-making role, the need to obtain appropriate conclusions in expert reports (without exaggerating their contribution) and the existence of providers of expert forensic opinions outside state channels. MacFarlane (2006) notes the need for a special assessment in admissibility proceedings when the technical evidence is based on new technologies. We will take up these points again later.

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[56] Saks & Koehler (2005) give a large percentage (63%) of cases of judicial error where the forensic sciences were at fault. This figure was quickly put in perspective by Collins and Jarvis (2009).

[57] See in this connection (National Institute of Justice, 1996; Garrett, 2008; Garrett & Neufeld, 2009).

[58] We believe that the reliability of incriminating and exonerating evidence should be examined in a similar way, this issue being independent of that of the decision threshold.

[59] The prosecution must prove the defendant's guilt beyond reasonable doubt (which means that the judge or jury must be personally convinced thereof), while the defence only has to instil reasonable doubt in order to secure acquittal.

3. Dealing with evidence in criminal justice systems of the accusatorial and inquisitorial traditions

3.1. General structures

The aim of this section is to give a brief description of the two main kinds of procedural arrangements in use in European states[60]. Although the distinction is exaggerated, with a good number of legal systems borrowing from the other kind, it does seem vital to give thought to the structure of legal systems before taking a critical approach to the interpretation of scientific evidence by lawyers.

In a legal system of the **accusatorial tradition**, the prosecution and defence present two versions of the facts to a jury which is required to decide which of the two versions is accurate. The judge acts as a mediator: his or her role is primarily passive and reactive. The impetus to take the investigation forward is thus provided by the parties, which bear responsibility for adducing evidence in support of their position (producing substantive evidence, having their witnesses and expert witnesses interviewed). A complex body of rules determines which evidence is admissible and which must be excluded from the proceedings. A set of rules on disclosure also ensures that each party is aware of the information needed for the trial to be prepared fairly. The proceedings are mainly oral, and the trial holds a central position, as it is only at that stage that the jury takes cognisance of the case. The witnesses (including experts) are directly examined and cross-examined by the parties during the proceedings.

In a legal system of the **inquisitorial tradition**, the investigation is conducted by an examining judge, who seeks incriminating and exonerating evidence with a view to establishing the truth; he or she collects substantive evidence, interviews witnesses and appoints experts if that proves to be necessary. The system is governed by the principle of freedom of evidence, according to which all forms of evidence are a priori admissible, with just a few exceptions. The examining judge has in his or her possession the case-file containing all the documents relating to the proceedings and all the accumulated evidence, and this file can be consulted by all the parties. This preliminary phase, which is secret, written and non-adversarial, is sometimes[61] followed by an oral, public and adversarial phase: the examining judge then forwards the case-file to a (different) judge who, or to a court which, holds proceedings based mainly on the material

[60] We refer to this distinction between accusatorial and inquisitorial systems because these terms are convenient, but we are aware that some writers prefer to call the latter either a "mixed system" or the "reformed system" and use the adjective "inquisitorial" only when referring to the secret written procedure used in mainland Europe from the 13th century onwards (Damaška, 1973, pp. 556-557).

[61] In practice, the examining judge is, in certain legal systems, empowered to convict in a number of less serious cases, thus bringing these cases to an end at that point.

already in the file, of which the judge/court will therefore have prior knowledge. The judge/court can also decide to take further evidence, if insufficient information is considered to be available to reach a verdict. During the trial, witnesses and experts are usually examined by the judge, who thus has an active role and takes a more directive approach.

3.2. Dealing with evidence

When it comes to collecting and dealing with evidence in general, the benefits and drawbacks that the two systems are generally considered to have are set out below.

In **inquisitorial systems**:

- the neutrality of the investigation depends on the impartiality of the examining judge responsible for the case;
- the contribution of the defence to the building of the case is limited, a corollary of the examining judge's neutrality being that the parties have a limited power of investigation of their own[62];
- since the judge/court has prior knowledge of the case before the trial, some people perceive a risk of bias, one all the higher for the fact that a neutral judge conducted the investigation before him or her and considered that the incriminating evidence was sufficient for committal for trial;
- during the trial, the parties cannot cross-examine the witnesses and experts giving evidence unfavourable to them, and this is sometimes deemed to deprive them of an effective means of challenging those persons' credibility[63];
- the defence generally has complete knowledge of the case-file and the evidence gathered[64]. Although further evidence may be adduced by the

[62] Coercive measures (searches, telephone tapping, etc) being prohibited to them. Also sometimes prohibited to them is contact with witnesses outside the procedural framework; otherwise Bar ethics discourage this practice. It is always open to the defence to offer evidence, which may be refused by the examining judge on the grounds that it is not relevant or that the facts have already been sufficiently proven. This brings us back to the concept of assessment of evidence at an early stage, which may, in our opinion, be problematic when that evidence is scientific, as such evidence is widely assumed to be accurate, and it will often be difficult for the defence to demonstrate the merits of a challenge to the accuracy thereof.

[63] Questions are put mainly by the judge, who may authorise counsel to address the persons being interviewed directly. In such a case, however, counsel are expected to show restraint, and there is no cross-examination as such, comparable to that in accusatorial systems.

[64] This statement nevertheless has to be qualified: in practice, the defendant's right of access to the file at certain stages of the procedure and right to participate in dealing with evidence (including expert report writing activities) may be restricted by certain legal systems.

parties or requested by the court during the hearing, the surprise effect is not part of such a judicial culture.

In **accusatorial systems**:

- the role that the defence is able to play in the investigation is theoretically greater;
- the role of the defence is nevertheless frequently limited in practice by the resources at the defendant's disposal[65];
- some investigative acts can be carried out only by the public authority (such as conducting a search). Thus, *de facto*, the two parties are not in the same position[66];
- cross-examination is considered to be a very effective means of testing the credibility of witnesses;
- examination of witnesses and experts by the parties directly may bring a risk of their evidence being distorted for the examiner's own purposes, especially if the persons under examination, while competent in their own field, are inexperienced in the art of public speaking (as is typical of scientific experts);
- the arrangements for disclosure of information are asymmetrical[67], which is not conducive to a transparent assessment of scientific evidence[68].

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[65] It is clearly understood that persons in financial hardship may benefit from free legal aid, and that this may cover the costs of any expert report. Such persons will, however, be in a weaker position than the prosecution when it comes to commissioning an expert report or a second expert report, since the costs thereby incurred always entail a risk of financial loss, and the degree of inclination to take such a risk depends on the level of financial resources available.

[66] Spencer (2002a, p. 626) drew the conclusion that, in England, "the duty to look for evidence for the defence belongs to nobody", and points out that, in order to alleviate this shortcoming, a "public defender" exists in certain Australian and American jurisdictions, with a status equivalent to that of the public prosecutor, and he or she is responsible for this task when the defendant so requests.

[67] In practice, the prosecution service in the United Kingdom has, since 2003, been required to communicate to the defence the material collected during the investigation which might have an influence on the outcome of the case (principle of relevance), and this applies even if the material concerned is not presented as evidence at the trial. The defence, for its part, has to communicate to the prosecution its main arguments relating both to the facts and to the law. The prosecution must then reconsider the relevance of additional information on the basis of the defence arguments presented by the accused and, if need be, communicate this (Durston, 2008, p 55; Sommer, 2009, p 146).

[68] We agree with the idea that, where scientific expert reports are concerned, disclosure should be symmetrical and complete. To this end, expert reports should be as full as is possible (Meintjes-van der Walt, 2003, p. 93).

3.3. Scientific evidence in particular

Where the use of scientific experts more specifically is concerned, different solutions have been adopted for the two systems[69].

Accusatorial systems rely first and foremost[70] on presentations by experts chosen by the parties, instructed and financed by them, having the same status as witnesses[71]. The main advantages and drawbacks in terms of scientific evidence which this procedural structure is acknowledged to have are set out below[72].

- the system masks areas of agreement between good scientists and encourages arguments between expert witnesses well trained in rhetoric;
- expert witnesses cannot convey their results freely, for this is always done through an examination or cross-examination, and is therefore always distorted in one direction or another; it should be pointed out in this context that, in such a system, written reports submitted by experts are traditionally brief, by which is meant largely factual, since it is during the adversarial proceedings that the contribution of the technical material in the case will be discussed and will take shape;
- the system is more exposed to the risk of evidence being given by (knowingly or unwittingly[73]) biased expert witnesses;
- expert witnesses are chosen for their ability to impress the court[74], and not for their scientific skills;
- the defence needs to have sufficient financial resources to be able to use expert witnesses with a reputation as good as prosecution experts';

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[69] Although the dividing lines between them are not hermetic. While the Italian procedure is accusatorial, experts can be appointed by the authority (and the parties may also have *consulenti tecnici*).

[70] Courts in the United Kingdom also make use of experts whom they appoint during the sentencing phase (Spencer, 2002a, p 633), and courts in the United States have for many years been able to call on the services of an independent scientific adviser in order to establish the facts, although they rarely do so (Black *et al.*, 1994, p 793).

[71] Although their field of action is greater than that of witnesses, since they can inter alia give their opinion (and not merely recount the facts), state the opinion of their scientific colleagues (notwithstanding the prohibition of hearsay evidence), make their statement in written form (something rarely allowed for other witnesses, who have to comply with the principle of immediacy) and be paid. On this subject, see Alldridge (1999, p 149).

[72] On these matters, see Spencer (1992), Alldridge (1999) and Lucas (1989).

[73] It also has to be borne in mind that the expert witness has received instructions from one of the parties and is not therefore certain to receive all the relevant information about the question raised.

[74] Spencer (1992) goes as far as to claim that the skills of the convincing expert witness and the good scientist are irreconcilable, for the former has to be self-confident and sure of his or her results, and uphold these under cross-examination, whereas the latter's main quality is open-mindedness.

- the accusatorial system theoretically makes it possible to cast effective doubt on any questionable statements made by the expert of one of the parties;
- if expert witnesses can potentially be perceived as the parties' "hired guns", science loses its capacity to persuade, whereas it is precisely for its reliability that science is used by the justice system;
- cross-examination is an inappropriate way of sorting the wheat from the chaff where scientific evidence is concerned: the expert witness's cognitive capacities (perception and memory), motivation and prejudice are frequently not in doubt, but the methodology itself may be biased and give false results[75].

As for **inquisitorial systems**, most use official experts, sometimes included on lists or from accredited laboratories, appointed by an examining judge or the court[76] and working under their supervision[77], with a status superior to that of witnesses. The parties are not completely cut off from the expert reporting process, since it is sometimes possible for them to request that certain specific questions be put to the expert (and therefore certain tests carried out)[78], to make comments on the expert's report once it has been placed in the case-file, to raise supplementary questions and possibly request the appointment of an expert to

[75] Black, Ayala & Saffran-Brinks (1994, p 789).

[76] However, not everyone who has scientific knowledge and works on a criminal investigation has expert status. In French law, in fact, the scene-of-crime officer who takes the first samples and carries out the first tests during an investigation does not have the status of an expert, as he or she has not been appointed by a court. The expert proper is the person who subsequently comments on the work done by the scene-of-crime officer (Spencer, 1992, p. 227). In Swiss law, the status of these officers is uncertain. The new Federal Code of Criminal Procedure (which comes into force on 1 January 2011) seems to settle the issue by making them subject to a more flexible expert reporting system (Vuille, 2010). The appropriateness of this regulation is nevertheless questionable. In practice, some officers make use of this distinction to evade unpleasant questions which might be put to them, relying specifically on their lack of expert status in the strict sense. In accusatorial systems, however, this difference does not exist, and all scientific officers are in the same position, whether they are involved in the procedure during the investigation phase or only during the trial.

[77] Some inquisitorial systems allow the parties to make use of "private experts" taken on, instructed and paid by them. In such cases, provision is made for them to participate in the procedure, which grants them a status which may or may not be equivalent to that of the official experts. Other inquisitorial systems are silent about scientific advisers taken on by the parties, and here the court receives reports by such persons as mere arguments by a party, is not obliged to interview them at the hearing and, if applicable, may decide to interview them as mere witnesses. Italian law provides for scientific advisers to be appointed for each of the parties, and they work with the official expert (Art 230 CPP/Italy). Nota: CPP stands for Criminal Procedures Code.

[78] Art 165 CPP/France, Art 184 CPP/Switzerland.

give a second opinion[79], to request the expert at the hearing to clarify material which is still unclear[80], and to have their own private expert interviewed. The main advantages and drawbacks of these systems are set out below[81].

- there is a risk that a court may place a considerable amount of trust in incompetent experts, protected by their special status from acrimonious attacks by the defence[82];
- in certain fields of expertise[83], this problem is counterbalanced by a system of accreditation (or official lists) intended to guarantee the competence and reliability of the scientists who assist the justice system. In practice, however, these accreditations sometimes create a situation in which the best qualified experts work exclusively with the prosecuting authorities, not only depriving the defence of valuable resources, but also, over the longer term, raising questions as to their neutrality, and may at the very least give rise to an impression that an obstacle is being placed in the way of the defence;
- the parties may raise questions throughout the procedure, giving the expert an opportunity to reconsider his or her position calmly and impartially (in his or her own office or that of an examining judge[84]), and this, in our opinion, is beneficial.

In the next section, we shall study the principle of equality of arms and the procedural stages during which it may be infringed when scientific evidence is being dealt with. The European Convention on Human Rights is binding on states which have different procedural traditions, whether accusatorial or inquisitorial, and is therefore implicitly based on the idea that the structure of the judicial system is not in itself a relevant factor in the context of compliance with the

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79 Which will be all the easier to obtain if the defence successfully argues about the shortcomings of the initial expert report. This is an area which is certainly crucial where equality of arms is concerned.

80 Art 168 CPP/France.

81 On these questions, see Spencer (1992) and Alldridge (1999).

82 Spencer (2002a, p 634).

83 In Switzerland, for example, DNA tests can be carried out only by one of the six laboratories accredited by the Federal Department of Justice and Police. But there is no system of accreditation for many other fields of scientific expertise. In France, in contrast, all the experts involved in court proceedings have to go through a relatively cumbersome procedure in order to be included on the official lists of experts (Art 157 CPP/France; in exceptional cases on the basis of a reasoned decision, an expert whose name is not on the list may nevertheless be chosen).

84 Spencer (1992), p 232.

principle of equality of arms. The two kinds of system are deemed to be equally capable of guaranteeing a fair trial[85].

However, as we have tried to show in the preceding paragraphs, use is made of scientific experts according to a different logic in the two systems, and the problems associated with the preparation and interpretation of scientific evidence arise to varying degrees, depending on whether the expert has been appointed by the authority or commissioned by one of the parties. As we give thought to the use of science by the justice system, therefore, we cannot leave completely out of consideration the procedure in which it takes place, although, as we shall explain below, a large portion of the problems that this raises can be resolved by setting minimum requirements in respect of the substance and assessment of expert reports in both systems.

4. Equality of arms

4.1. Concept

Equality of arms is a principle which derives from the guarantee of a fair trial[86]. It requires equality between the parties in procedural terms, meaning that each of them must have a reasonable opportunity to present its case in conditions which do not place it at a clear disadvantage vis-à-vis the other parties[87]. Equality of arms is not in itself a right, but a principle intended to ensure that the parties' rights are realised in a balanced manner. The parties must also have the right of equal access to relevant information[88] and an equal opportunity to have their say and present their arguments and observations, and their scientific experts must be given equivalent status[89]. The concept does not, however, have absolute scope. According to settled case-law, equality of arms is a matter to be assessed on a concrete basis (ie in each individual case), and with the procedure as a whole being taken into account (and not each part thereof)[90].

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85 Summers (2006, p 104).

86 ECHR, case of *Delcourt v. Belgium* of 17 January 1970, § 28; ECHR, case of *Brandstetter v. Austria* of 28 August 1991, § 66.

87 ECHR, case of *Dombo Beheer B.V. v. the Netherlands* of 27 October 1993, § 33. Thus the perspective is a comparative one, and the principle is not violated if both parties were deprived to an equivalent extent of the opportunity to act (Trechsel, 2005, p 97).

88 Subject to the disclosure arrangements in accusatorial systems. In inquisitorial systems, all relevant information is collated in the case-file, to which the parties have access (sometimes subject to restrictions at certain stages of the procedure).

89 ECHR, case of *Brandstetter v. Austria* of 28 August 1991.

90 ECHR, case of *Mantovanelli v. France* of 17 February 1997.

Related to the concept of equality of arms[91] is the principle of adversarial proceedings, implying first and foremost the defendant's right to be present at the different stages of the procedure[92], and, secondly, the right of the defence to an opportunity to have knowledge of and consider the arguments of the opposing party[93] and, in particular, to comment on the evidence presented[94].

4.2. The expert's position in the procedure and its effect on equality of arms

The concept of equality of arms thus implies a comparative study of the respective positions of the parties in the procedure. In a system of the accusatorial tradition, in which each of the parties appoints its own experts, this means that the defence expert must be placed on the same footing as his or her prosecution counterpart[95]. And in an inquisitorial system? While the prosecution certainly is the defence's "opposing party", what is the status of an expert appointed by the court?

In an inquisitorial system, the expert is regarded as theoretically neutral[96], irrespective of whether his or her conclusions incriminate the defendant or are favourable to him or her. The European Court of Human Rights (ECHR), however, has ruled in a number of judgments involving inquisitorial-type procedures that the defence had been placed in a disadvantageous position and

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[91] Both are component parts of the right to a fair trial. This distinction, while useful in the civil context, may seem somewhat theoretical in the criminal framework, since the evidence which the defence may wish to challenge is always presented by the prosecution, and the two principles are therefore violated simultaneously (Summers, 2006, p 119).

[92] A principle to which there are, however, some exceptions, particularly in appeal courts.

[93] It has been deemed incompatible with the principle of adversarial proceedings for the prosecutor to decide unilaterally not to disclose certain information in order to protect a paramount public interest; a court ruling has to be issued on this subject (ECHR, case of *Rowe and Davis v. the United Kingdom* of 16 February 2000, § 66-67). On the other hand, if the defence is informed of the existence of the evidence and has the opportunity to challenge the court's decision authorising non-disclosure, the principle has not been violated.

[94] ECHR, case of *Brandstetter v. Austria* of 28 August 1991, § 66-67; ECHR, case of *Rowe and Davis v. the United Kingdom* of 16 February 2000, § 60.

[95] For instance, if the prosecution expert has the right to examine a witness or another expert directly, the defence expert must be given the same right.

[96] Although Article 6 § 1 of the European Convention guarantees the right to a fair hearing by an independent and impartial tribunal without specifying any requirement for experts to meet the same standards, the European Court of Human Rights recognises that the conclusions of an expert appointed by that tribunal may well have considerable influence on its decision. In this context, an expert's lack of neutrality may violate the principle of equality of arms. As in respect of the tribunal, the question of impartiality is therefore examined from two angles: in the subjective sphere, a judge's personal impartiality is presumed to exist until it is proved otherwise. Irrespective of the judge's attitude, however, if one of the parties entertains doubts as to his or her impartiality, the question has to be asked of whether these doubts are objectively justified.

that equality of arms had therefore been violated, since no corrective action had been taken.

In its judgment in the case of ***Eggertsdottir v. Iceland***[97], the Court considered whether the composition of the body of experts gave rise to legitimate fears of prevention of equality. The applicant in that case complained about the membership of the body which had supplied to the Icelandic Supreme Court an expert opinion on the possible causal relationship between alleged failures by the medical profession and the disability from which she suffered. The body concerned (the SMLB, State Medico-Legal Board), acting on the court's instructions, was made up of nine members, four of whom were employed at the hospital where the events had occurred, although they had played no part in these. Three of them were also members of the Forensic Chamber to which the Board had previously referred the matter for examination. The European Court of Human Rights considered that this situation gave rise to understandable apprehensions in the applicant as to the impartiality of the court, and that these apprehensions were objectively justified, in so far as the members of the SMLB had not only been instructed to give an opinion on a certain issue, an opinion which might or might not have differed from the opinion previously expressed by their National and University Hospital colleagues or the Chief Medical Executive, but had also been instructed to assess their colleagues' acts, while knowing that the Chief Medical Executive had already supported those colleagues in a document written in reaction to the judgment at first instance. Furthermore, it emerged from the judgment of the Icelandic Supreme Court that the SMLB's expert opinion had carried significant weight in its decision. Equality of arms had thus been violated.

The Court also recognised a violation of the principle of equality of arms in the case of ***Stoimenov v. the former Yugoslav Republic of Macedonia***[98]. The defendant had been prosecuted for production of, and trade in, narcotic substances. The products seized, which the defendant denied were narcotics, had been analysed by a laboratory attached to the Ministry of the Interior, which had found evidence against the defendant on the basis of reports supplied by an expert concluding that the substance was indeed opium. The applicant had asked for a second expert opinion, on the grounds that the expert was not independent and that there were doubts as to the accuracy of the reports. This request was dismissed. The domestic court convicted the applicant, largely on the basis of the expert reports. The Court took the view that the expert should be considered to be the prosecution's expert, since he had not been appointed by a court, but by the Ministry of the Interior, ie the authority which subsequently initiated the prosecution, and that the applicant should have been allowed a second expert

[97] ECHR, case of *Sara Lind Eggertsdottir v. Iceland* of 5 July 2007.
[98] ECHR, case of *Stoimenov v. the former Yugoslav Republic of Macedonia* of 5 April 2007.

report. He had in practice had no opportunity to have the products at issue analysed by a private scientific expert, as the products had been confiscated by the authority.

In the judgment in the case of ***Bönisch v. Austria***[99], the Court recognised a violation of the principle of equality of arms because the expert (a scientist later appointed as expert by the court) had set in motion the criminal prosecution and should therefore have been considered to be a prosecution expert, and consequently the expert presented by the defence should have been placed on an equal footing with him, which had not been the case, as the defence expert had been interviewed as a mere witness, whereas the prosecution expert had been interviewed as an expert and allowed to attend the hearings, put questions to the defendant and to witnesses and comment on their evidence.

The situation was different, on the other hand, in the case of ***Brandstetter v. Austria***[100]. The court had appointed an expert and subsequently refused to interview any other expert but him. The expert instructed by the court belonged to the same institute as the person who had set in motion the criminal action, but the Court refused to regard him as a prosecution expert, because the defence did not successfully establish objective facts which would have called into question the expert's impartiality, and his mere belonging to the institute which had set in motion the prosecution was not sufficient to cast doubt on his neutrality. Taking any other view, according to the Court, would have had the effect of restricting to an intolerable extent the number of experts at the disposal of the court system. Furthermore, the mere fact that the expert appointed by the court presented evidence supporting the case of the prosecution did not oblige the court to appoint other experts at the request of the defence.

Sometimes it is not so much the position of the expert in the procedure which raises a problem as the impact of his or her evidence, deemed to be unfair for some external reason. In the case of ***G.B. v. France***[101], a psychiatric expert[102] was handed, while he was being interviewed, documents relating to the applicant's previous criminal activity, including offences of rape and sexual assault, and which the public prosecutor's office had placed in the case-file at the beginning of the hearing. He was granted a 15-minute adjournment of the hearing in which to read these. When the hearing resumed, he completely changed the assessment of the situation that he had made in his written report, which he had initially confirmed orally. The defence then requested a second expert report,

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[99] ECHR, case of *Bönisch v. Austria* of 6 May 1985.

[100] ECHR, case of *Brandstetter v. Austria* of 28 August 1991.

[101] ECHR, case of *G.B. v. France* of 2 October 2001.

[102] In this instance we move beyond the field of reports by experts in hard sciences, but this particular case seems to provide a relevant illustration of the need for transparency when expert reports are drawn up.

which was refused, and the applicant was ultimately sentenced to 18 years' imprisonment. He complained that he had not received a fair trial, particularly because his request for a second expert opinion had been rejected. The Court pointed out that a court's refusal to appoint a second expert when the first expert's conclusions were unfavourable to the defendant did not, per se, constitute a violation of the Convention[103]. However, the Court also took the view that, in that case, the expert had not just expressed a different opinion during the hearing from the one which appeared in his written report, but had performed a complete volte-face during one and the same hearing. Such an abrupt change of opinion was very likely to have made an impression on the members of the jury and therefore to have influenced the verdict. A second expert report should therefore have been ordered.

These few ECHR judgments show that there are some cases, notwithstanding the supposedly neutral position of the expert in the inquisitorial system, in which this neutrality is no longer ensured and the way in which the results of the expert examination are presented can no longer be regarded as fair. In such cases, the remedy advocated by the Court is to require courts to appoint a second expert who would act as a kind of "defence expert" in order to counterbalance the effects of the first expert report[104].

It is nevertheless our opinion that this should in fact be a last resort, for this solution brings with it its own problems, as we shall see later. In particular, it does not solve the main problem, that of knowing how the courts will assess two expert reports setting out differing theories. We therefore suggest that thought be given to an earlier stage of the procedure, the time at which expert reports are written, whatever the position of the expert in the procedure. We call for maximum exchange of information between experts and parties, from the moment that experts are appointed, for a surprise effect can only be detrimental to a balanced and considered assessment of scientific evidence. For it is indeed expert reports or statements that need to be balanced and to reflect the respective positions of the different parties.

4.3. Participation by the defence in the production of expert reports

In order to be intellectually complete and to serve the cause of justice as effectively as possible, the work of scientific experts must always comprise an

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[103] ECHR, case of *Brandstetter v. Austria* of 28 August 1991, § 46.

[104] The influence of the *Bönisch* and *Brandstetter* cases on the decisions taken by domestic courts is shown by an example from the Supreme Court of the Netherlands (Hoge Raad, 24 April 1992, NJ 1992, 644) recognising the right to a second expert opinion if certain formal conditions are met (Jakobs & Sprangers, 2000, p 379).

evaluation of their technical findings in the light of two opposing hypotheses: the facts as stated by the prosecution and the explanations put forward by the defence. This makes it crucial for experts to be told as soon as possible the position taken by the defendant in respect of the acts of which he or she is accused, and to be advised of any new evidence which might influence their assessment of the two conflicting hypotheses. This is why criminal procedure should allow sufficient scope for the parties (and more specifically the defence) to intervene at an early stage of the investigations and throughout the process.

In its judgment in the case of ***Mantovanelli v. France***[105], the Court took the view that the principle of adversarial proceedings had been violated in a case in which one of the parties had not been informed of the date on which the expert would interview witnesses and examine certain documents. It had not been given an opportunity to attend to put questions to the said witnesses and request additional investigations. It had not therefore been able to participate in the production of the report, a report which, once it had been drawn up, was likely to influence the court significantly, because of the complexity of the questions raised and the significant linkage between the question put to the expert and the one which the court was to decide.

The Court nevertheless pointed out that the principle of adversarial proceedings could not give rise to a general right to be present during the expert's activities, as the principle should be applied to the proceedings before the "tribunal" in the broad sense. One member of the Court, furthermore, in a dissenting opinion, stated that the principle of adversarial proceedings had to be respected in the proceedings "as a whole"[106], so it was sufficient for a party to have the opportunity to challenge the expert report in court when the evidence was assessed.

We agree with the two arguments adduced by the Court. It is difficult to imagine, particularly where reports by technical experts are concerned, the parties and their defence counsel, possibly accompanied by private advisers, "supervising" the expert's activities and monitoring the way in which he or she carries them out[107]. This would prevent the expert from taking an impartial approach to his or her work. It is, however, vital for the defence to participate, by putting questions to the expert prior to the report process and by making observations after the report has been delivered or after the expert has been interviewed at the hearing. This is the only way of guaranteeing that the expert will work in a balanced way and examine all the relevant hypotheses.

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[105] ECHR, case of *Mantovanelli v. France* of 17 February 1997, § 33 and 34.

[106] In other words the proceedings must be regarded as a single entity, and not in terms of their separate phases.

[107] Criminal procedure in Italy provides for scientific advisers to the parties to be present during the reporting expert's activities (Art 230/2 CPP/Italy).

4.4. Definition of an expert report

Introduction of a broad right of participation for the defence in the production of expert reports can serve equality of arms only in so far as national legislation provides an appropriate definition of the expert report. It would in fact be conceivable for the defence in some cases to be denied some of its rights, as the law would define certain kinds of tests as routine operations automatically entrusted to certain laboratories and thereby to some extent falling outside the regulations on expert reports[108].

4.5. Potential risks in terms of equality of arms

In both accusatorial and inquisitorial systems, the defendant is placed in a position of disadvantage as compared to the prosecution, so equality of arms may well be infringed. This occurs for the following reasons inter alia[109]:

– *Stage at which the defence intervenes*
The second or defence expert becomes involved at a later stage than the official/prosecution expert, being appointed either in response to the first expert report or by defence counsel, in which case a suspect has already been arrested. So, during the critical phase in which samples are taken, who ensures that the crime scene is examined in a neutral and comprehensive manner? How can a second or defence expert carry out the same tests as the official/prosecution expert if the latter has (several weeks or months previously) used destructive methods leaving no further scope whatsoever for analysis?

The shortcomings of the investigation at this stage are very difficult (or may even be impossible) to make good, inevitably placing the defence at a disadvantage vis-à-vis the prosecution. Consequently, in many cases, the second or defence expert will not examine samples in their original form, but those pre-selected and prepared by the official/prosecution experts[110], and his or her role will usually be confined

[108] See, for instance, Switzerland's new criminal procedure, which excludes from the ordinary arrangements for expert reports a range of laboratory tests deemed to be reliable enough not to have to be commissioned in an adversarial context (cf Art 184 (3), 2nd sentence, CPP; see Vuille (2010).
[109] On these issues, see Roberts (1994, p 477) and Spencer (1992, p 221ss).
[110] Roberts (1994, p 491)

to an examination after the event of the work done by the official/prosecution expert[111].

– *Shortage of experts*
In any given field, and in any given court, it is frequently the case that few experts sufficiently independent in professional terms and capable of giving a reliable and useful opinion are available. The situation in this respect is similar in countries of both the inquisitorial and the accusatorial traditions. A court may therefore have difficulty finding an appropriate expert[112], in the same way as defence counsel may have difficulty locating a skilled expert working in equivalent conditions to those of prosecution experts[113]. Assuming that European harmonisation occurs, it would be an advantage to pool experts together in their specialist fields.

– *Lack of scientific knowledge and resources on the part of the defence*
It is the specific task of those who write expert reports for the courts to give those courts knowledge that they need but do not possess; a lack of knowledge thus clearly exists. In our opinion, however, the problem runs deeper than this: firstly, lawyers and judges are unaware of the underlying scientific implications of an expert report, which they consider to be in principle accurate[114], making it awkward for the defence to challenge it in any way and extremely unlikely that such a challenge would be successful.

And secondly, even if they wished to make a critical assessment of an expert report, their scientific knowledge is so incomplete that they would be incapable of identifying the evidence which might give rise to a problem. It will frequently be up to the defence to demonstrate why the expert report needs to be called into question and, should this be the case, why a second report is necessary, which is a very difficult task if the lawyer has no scientific training[115]. The defence can, of course, obtain the

[111] Spencer (2002a, p 633); Alldridge (1999). In an inquisitorial system, the fact that it can only point to alleged shortcomings in the official expert report may have the effect of discrediting the defence (as it is criticising a person selected by the court).

[112] A problem which was also noted in the Eggertsdottir case (ECHR, *case of Sara Lind Eggertsdottir v. Iceland* of 5 July 2007).

[113] The court, or the prosecution, effectively holds a long and varied address list, as well as enjoying well tried and tested working relations with skilled experts working for accredited bodies. The second or defence expert, in contrast, will have to be sought outside these well-known communities and will not have the same level of prestige, and the court, or defence counsel, will not enjoy the same relationship of trust with him or her as with an expert with whom they have been working for a long time.

[114] For the reasons already mentioned: trust in science in general, and in the appointed expert in particular.

[115] In this context, see Murphy (forthcoming, pp 24-25).

assistance of a private adviser for this purpose, but has to pay for this if it does so (at least on a provisional basis, pending the decision on the case).

The second generation of scientific evidence (here we are using Murphy's suggested terminology[116]) raises even more problems in terms of the defence's access to the facilities needed in order to refute effectively the official/prosecution expert's statements. In particular, it calls for highly complicated and very costly analytical instruments[117], its use involves databases managed by governments[118], and its interpretation is sometimes done with the assistance of databases constructed in a way which is difficult for the defence to ascertain[119].

In our opinion, accusatorial and inquisitorial systems alike do not lend themselves to sound management of scientific evidence. The accusatorial system, by giving the parties prime responsibility for finding evidence, presents the risk of penalising the defendants who are already at the greatest disadvantage. Furthermore, it entrusts to the judge or jurors the task of assessing scientific evidence in the worst conditions imaginable, ie in a spirit of "contradiction for contradiction's sake", and it seems to us that these persons have little capacity to determine the probative value to be given to such evidence on the sole basis of the scientific merits of the evidence, irrespective of the personality and behaviour of the experts and lawyers during the hearing. As for the inquisitorial system, it is based first and foremost on the court's trust in an expert assumed to be both neutral and competent. Hardly ever is the

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[116] Murphy (forthcoming, pp 4-6) distinguishes between first and second generation scientific evidence, the latter having added value because (1) it is found in the context of a wide range of offences; (2) it is very frequently detected by the persons responsible for finding evidence at a crime scene; (3) developments in this field have often coincided with the introduction of databases offering a significant investigative capacity (easy identification of suspects). In addition, second generation scientific evidence is distinguished from that of the first generation by two facts: (4) it is based on complex techniques, and (5) it raises hitherto (almost) unknown ethical issues and issues relating to privacy.

[117] Which brings us back to the question of the number of experts available in any given area, and also to that of access to accredited laboratories (which sometimes refuse to carry out tests other than on the instructions of a judicial authority, and cannot therefore be instructed by a lawyer to produce a private expert report; a lawyer wishing to obtain such a report will thus have to use non-accredited laboratories or persons, and this will in principle have a detrimental effect on the court's assessment).

[118] Databases on which the DNA and/or fingerprints of persons convicted or under suspicion and evidence found at crime scenes are stored.

[119] In the DNA field, for instance, the probability of an association to a given DNA profile (and consequently the degree to which it may be incriminating) is calculated using databases which record the counts of occurrence of certain genetic characteristics in a given population. These databases may not be public, meaning that the defence's experts may have no access to them, and would not know how they have been created.

expert's work in fact called into question, and when it is, the evidence is not assessed on its scientific merits, but on the basis of exogenous factors. The assessment of evidence can therefore be described as similar, and unsatisfactory, in both systems, for it is based on elements extraneous to the scientific method itself.

5. Admissibility of scientific evidence

5.1. Introduction

Contemporary European legal systems are familiar with the principle of freedom of evidence, meaning that a court may consider any type of evidence to establish the facts (there is no exhaustive list of admissible types of evidence[120] and in general there is no mandatory evidence whose absence would prevent conviction[121]). Yet there are two kinds of exception to this rule[122]:

A first category of evidence cannot be admitted because, despite its (hypothetical) reliability, **considerations extraneous to the quest for truth** dictate that it be left out of account. Thus certain legal systems, both accusatorial and inquisitorial, preclude consideration of a number of classes of evidence when adduced contrary to the statutory provisions[123], for example in breach of the prohibition of torture, by means limiting the free will of the person subjected to them (hypnosis, narco-analysis etc) or again in breach of the procedural rules

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[120] This is the case with Swiss law. Some legal systems, however, exhaustively list the admissible types of evidence (for example, Netherlands law; see Meintjes-van der Walt, 2001, p. 148). Sometimes it is not the evidence but its very object that is ruled out. For example, Article 220 (2) CPP/Italy prohibits establishing the defendant's "tendency to break the law" by taking expert evidence.

[121] By way of an exception, the law compels the court to avail itself of certain kinds of evidence. In Swiss law, it must for example appoint a psychiatric expert before ordering an internment measure, a medical expert to carry out an autopsy, etc. In German law, the court cannot make a finding of guilt before it has assessed one of the 5 types of evidence prescribed in the *Strafprozessordnung* (Juy-Birmann, 2002, p. 325).

[122] The European Court of Human Rights holds that admissibility of evidence is a matter for regulation under national law (ECHR, case of *Schenk v. Switzerland* of 12 July 1988, § 46), and rules only as to whether the proceedings, *"considered as a whole, including the way in which evidence was taken, were fair"* (EurCourtHR*, case of Kostovski v. Netherlands* of 20 November 1989, § 39.). That is, unless the gathering of evidence has been done in a way that infringes the Convention, for example under torture, in which case the evidence must be deemed utterly unusable.

[123] Whereas certain types of evidence will invariably be dismissed (particularly where contrary to a provision of the ECHR, such as admissions extracted under torture), there will often be a weighing of interests between the seriousness of the offence prosecuted and the importance of the procedural rules infringed in order to obtain the evidence, taking into account the effect that the breach of procedural norms may have had on the reliability of the evidence in question.

governing the manner of obtaining certain evidence (searches or telephone tapping without a valid warrant, questioning of a witness not having been informed of his or her rights, taking a biological sample outside the legal framework, etc). This stems from a concern to ensure that the state complies with the same rules of conduct as it imposes on its citizens in the prosecution of offences.

A second category of evidence cannot be admitted because it would be **detrimental to the discovery of the truth.** It is excluded because it poses too great a risk of biasing the decision-maker (judge or jury) in relation to what it really contributes to the proceedings. Continental legal systems are traditionally less responsive to this argument than the British and American ones, and hold that the judge trying a case is capable of assigning the due probative force to all evidence adduced, without needing to make an initial selection[124]. Thus they know no *exclusionary rules* based on this second argument[125], whereas the Common Law accepts that a court may decide at its own discretion that a piece of evidence will be dismissed if, for example, its probative value is exceeded by the risk of confusion that it poses[126].

5.2. Scientific admissibility

The scientific admissibility of evidence, while subject to fairly precise rules in United States law, as will be shown, is seldom addressed in European legal writings, and continental legal systems[127] seem very uncommunicative on the subject[128]. The question of scientific reliability is seen as intrinsically linked with the assessment of the actual evidence, that is with the determination of its probative value: if its scientific reliability can be challenged, its probative value

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[124] Some consider that this difference of approach is linked entirely with the presence or absence of a jury, an opinion qualified by others (Damaška, 1973, p. 514).

[125] A continental judge may nevertheless refuse to adduce certain evidence (examining a witness, appointing an expert, etc.) despite its cogency, where he holds that such evidence will not alter the opinion which he has already formed of the case. On these issues, see Damaška (1973).

[126] *"(...) if its probative value is deemed to be substantially outweighed by the dangers of unfair prejudice or confusion of the issues."* (Durston, 2008, p. 34).

[127] It will be seen that English law regarding this question is in the midst of change and seems to be moving towards "Americanisation" of the system.

[128] The need to distinguish between procedural and scientific admissibility is furthermore not unanimously accepted, some legal commentators being of the opinion that scientific evidence must be admitted once it is obtained legally (ie is admissible in a procedural sense) and relevant, and any question of its scientific reliability must be part of the assessment of the evidence. Others take the opposite view that, given the complexity of the issues raised, this assessment should be made separately against clear criteria. On this point, see Hayajneh & Al-Rawashdeh (2010) and the quoted authors.

will be deemed slight, and vice versa[129]. The evidence is thus admitted at the outset, it then being up to the trial court when assigning the evidence its due probative value to take account of any errors that may have rendered it unreliable. US law on the other hand clearly distinguishes between these two phases: admitting expert evidence does not presuppose ruling on its probative value (hence on the comparative worth of two or more expert testimonies), but purely on its ability to assist in the task of deciding the case[130].

The scientific admissibility of scientific evidence may be determined in various ways: for example, focusing solely on the person of the expert and admitting all relevant evidence coming from an accredited expert or, at the other extreme, only raising questions about the intrinsic merits of the evidence itself without regard for the person who has analysed or interpreted it[131].

Black, Ayala & Saffran-Brinks (1994, p. 731) enumerate what they term *"surrogates for understanding science"*, ie criteria used by lawyers to assess scientific evidence which are unsatisfactory because they are not based on an understanding of the evidence adduced but on heuristics of reasoning[132]. Here is a non-exhaustive list of them together with the reasons why they are not enough:

- the *"general acceptance"* of the *Frye* decision: the definition of what should be accepted, in which scientific field, and to what degree of acceptance, makes it difficult to apply this criterion[133];
- *peer review*: this criterion does not indicate whether a technique accepted in scientific literature has been used properly in a given case;
- ascertaining the error rates of a test: that can prove misleading if not all its complexities are understood[134];

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[129] Redmayne (2001, p. 118) notes that the concepts of reliability, relevance and probative value are often confused. He also notes that the concept of reliability is at present completely underdeveloped in English law, and proposes a conceptualisation based on the concept of likelihood ratio or LR.

[130] Beecher-Monas (2007, p. 7).

[131] Alldridge (1999, p. 7).

[132] The heuristics of reasoning are mental short-cuts for taking decisions by activating a minimum of mental resources. An example documented in criminological literature is precisely the evaluation of an expert based on extraneous criteria rather than on the substance of what he says; see Ivkovic & Hans (2003), while Honess & Charman (2002) are more guarded. The heuristics of reasoning usually make it possible to take decisions that are good enough for the task at hand (hence their usefulness in terms of moving forward), but also sometimes generate error (as illustrated by the significant body of literature on the pitfalls of intuition in the evaluation of statistics).

[133] See para. 5.3 and the criticisms levelled at the *Frye* standard.

[134] For example, the positive result of an AIDS test with a false negative rate of 2.3% and false positives of 7.4% is deemed symptomatic of the disease in only 5% of cases (because of a low

- focusing on the expert's qualifications rather than on the substance of what he says: the expert's qualifications are a necessary but insufficient condition for a grasp of scientific evidence. Acceptance of the opposite would have the outcome of giving any qualified expert discretion as to what is legally relevant[135]. Furthermore, even a competent expert may have erred in the specific case;
- some assessment criteria focus on the instruments used or on the use made of them, for instance: Is the instrument new? Is it properly maintained? Quite obviously that cannot suffice, otherwise, taking the argument to extremes, a fortune-teller's opinion would be admitted on the pretext that she has a fresh pack of cards;
- finally, other plainly inadequate "surrogates" focus on the impact of an expert's opinion on the decision-maker, more specifically the jury, and especially the clarity with which the expert is able to present his opinion.

These elements, though, do not allow the scientific quality of evidence to be validly assessed. Black, Ayala & Saffran-Brinks (1994, p. 782 ff.) thus suggest the following criteria to help lawyers understand the scientific data before them:

- Explanatory power: a reliable science is descriptive and predictive; it offers a plausible explication for a mechanism;
- Falsifiability: a scientific hypothesis must be formulated in such a way that it can be empirically tested;
- Coherence: a reliable scientific hypothesis is coherent, does not contradict itself, and is not tautological;
- Diversity of the experiments conducted: the soundness of a hypothesis is the greater the more and more varied trials it has withstood;
- Consistency with established scientific theories: scientific knowledge is cumulative, that is a new theory is often founded on knowledge already acquired; a theory that drastically breaks with existing science should thus be viewed with scepticism;
- Use by the scientific community: the fact that a scientific theory is taken up and used by other members of the scientific community is a strong indication of its reliability;
- Precision: very vague generalisations are tenuous and very hard to put through varied experimentation to test their reliability;

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basal frequency, only one out of 250 persons in the population is theoretically infected) (Koehler & Saks, 1991).

[135] Faigman (1989, p. 1012); Huber (1991b, p. 199).

- Validation *a posteriori*: an *a posteriori* interpretation of pre-existing data to make them conform to a new hypothesis cannot constitute reliable scientific knowledge;
- Peer review and publication: though insufficient *per se*, these are two important indices of the thoroughness of the work performed.

As will be seen in the following paragraphs, current practice is rather remote from these prescriptions, as some courts apply criteria whose relevance is disputable (and energetically disputed!), while other legal systems adopt virtually a complete laissez-faire attitude and defer to the common sense of their magistrates.

5.3. Comparative law

a) The United States system

The United States[136] have seen several admissibility criteria in succession over the past century, which may be summarised as follows[137]:

In 1923 in the case of ***Frye v. United States***[138], a defendant charged with murder set out to prove his innocence with the help of a forerunner of the lie detector. The evidence was deemed inadmissible on the ground that it sprang from a technique that was not generally accepted in the relevant scientific community[139]. This is what we call the criterion of *"general acceptance"*.

Several decades later, this criterion was nevertheless deemed unsatisfactory for several reasons:

- Some considered it too conservative because it was necessary to wait for a method to become widespread in order for it to be used in a judicial context;

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[136] It should be observed that these criteria are applied variously over US territory because, while the federal courts are subject to the case-law established by the US Supreme Court, the state courts remain independent. As a consequence of this, certain states (not the least populous: California, Florida and New York) continue to apply *Frye*.

[137] See in particular Michaelis, Flanders & Wulff (2008, p. 215 ff).

[138] *Frye v. United States* 293 F 1013 (D.C. Cir. 1923).

[139] Note that prior to this judgment, the expert was merely asked about the nature of his qualifications and, if the subject-matter of his work went beyond the average knowledge of the jurors, he was accepted. Not to be content with the qualifications of a single expert, and to consult the scientific community, was thus the great advance ushered in by *Frye* (Huber, 1991b, p. 199). At present an occasional tendency to revert to this old criterion is noted, merely verifying the accreditation of an expert without examining the substance of his statements.

- to others, it was on the contrary too permissive because any technique might be made acceptable by defining the "scientific community" somewhat restrictively[140];
- it did not necessarily emphasise the real crux of the problem; for example, an analytical technique could be generally accepted, and so the cogency of the inferences made from the results did not come under scrutiny (Giannelli, 1980);
- the criterion of knowing what constituted "general acceptance" was variously applied by the courts.

Frye was based on the idea that the court should trust the judgment of the scientific community to determine the admissibility of scientific evidence. This conception of the relationship between expert and judge thus (implicitly) presupposed that the scientific community be regarded as a neutral group aspiring only to discern the truth. A major drawback of this approach was that the very persons with an interest in having a method declared admissible were asked for their opinion on it[141].

The entry into force of ***Federal Rule of Evidence* 702**[142] in 1975 sounded the knell of the *Frye* criterion[143]. Indeed, it required that expert testimony be relevant (as well as reliable) in order to be admissible, thereby making the *Frye* criterion insufficient[144]. So there was now a dual requirement of legal relevance to the instant case and scientific reliability of the method[145].

In 1993 in the case of ***Daubert v. Merrell Dow Pharmaceuticals, Inc.***[146], two children born with disabilities claimed damages from the manufacturer of the drug Bendectin, submitting that their mother's taking the drug during pregnancy (to combat morning sickness) had caused their disability. To determine the

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140 On this question, see in particular Cole (2008).

141 Faigman (1999, p. 62).

142 *"If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case."*

143 Whether FRE 702 actually signified that *Frye* should fall was debated for many years. The *Daubert* decision clarified the position by answering this in the affirmative.

144 Sanders, Diamond & Vidmar (2002).

145 The phases of the moon would, for example, constitute scientifically valid and legally relevant information in the field of astronomy but not of astrology (see Black et al., 1994, p. 747 quoting the example given by judge Blackmun in the Daubert decision).

146 *Daubert v. Merrell Dow Pharmaceuticals Inc.*, 113 S. Ct. 2786 (1993).

reliability of the expert testimony brought, the Supreme Court referred to the concept of scientific[147] validity[148], and proposed five criteria for its ascertainment:

- the method's falsifiability[149];
- peer review and publication[150];
- the method's margins of error (known or presumed);
- the standards governing application;
- general acceptance in the relevant scientific community[151];

While acknowledging that in general the jury alone should determine the probative value of a piece of evidence, the Supreme Court pointed out that only valid scientific evidence should be put to the jury, and that the judge must therefore evaluate the expert's testimony before its presentation to the jury, thereby vesting the judge with a mandatory role of *gatekeeper*[152]. By this *gatekeeping* procedure it is implicitly acknowledged that the accusatorial system is not a sufficient barrier to admission of unreliable evidence[153]. The *Daubert* factors mentioned above are assessed at the court's absolute discretion (in the light of supporting documents supplied by the parties and examination of their experts). In no circumstances is it expected that the technical element need meet the five criteria in order to be admitted[154].

A sixth criterion was added with the ***General Electric Co. v. Joiner* decision** (1997)[155], viz:

- Relevance to the case before the court, which entails examining the validity of the inferences made between the analyses and their practical application to the stated problem[156].

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147 In the case of *Kumho Tire Co. v. Carmichael*, the Supreme Court, while excluding non-scientific knowledge from the ambit of *Daubert*, pointed out that intellectual rigour in reasoning ought to apply not only to scientific knowledge in the true sense but to any type of knowledge drawn from experience or practice.

148 An indiscriminate use of the terms "*validity"* and "*reliability"* is noted in the literature. *Valid* means that the technique yields accurate results (close to the true value established with reference to standards). To be called *reliable*, the technique is expected to afford an adequate degree of precision (of reproducibility) and correctness. In forensics, *reliability* is sought first and foremost.

149 Can the method be tested? Has it actually been tested?

150 Which does not constitute a final test of reliability, but at least increases the likelihood that gross methodological errors will be discerned.

151 *Frye* is thus retained, but solely as one of the validity criteria.

152 Berger (2000, p. 11).

153 DeCoux, (2007, p. 146).

154 Assessments of fingerprint evidence along the lines of *Daubert* speak volumes here (Kaye, 2003).

155 *General Electric Co. v. Joiner* 522 U.S. 136 (1997).

Indeed, contrary to the idea that had been suggested in *Daubert* of the judge's examination needing to concern only the methodology employed and not the conclusions drawn from it, the Supreme Court held in *Joiner* that the conclusions and the method were always linked in some way, but that, while accepting the reliability of the analysis carried out, the judge must remain free to dismiss the inferences made from it by an expert when they went beyond what was reasonable.

Lastly, as the third pillar of the *"Daubert trilogy"*, the decision in the case of ***Kumho Tire Co. v. Carmichael*** (1999)[157] gave the Supreme Court occasion to specify the scope of this entire set of rules and thereby broadened the obligation imposed on courts to determine the reliability and the relevance of expert opinions were not strictly scientific, but based on observation and long experience[158]. Thus it was no longer a question of applying the *Daubert* criteria rigidly and establishing a taxonomy of reliable and unreliable scientific methods, but much more of encouraging a pragmatic approach based on the instant case before all else. For example, a judge should not enquire whether forensic document examination constitutes, *in abstracto*, an established science, but should know whether a given expert in a given case, working in a given way from given data, can produce reliable information capable of helping establish the facts[159]. The situation in Canada is observed to be very similar[160].

Contrary to the spirit of *Frye*, the *Daubert, Joiner and Kumho* trilogy of decisions implicitly emphasises the scepticism which the judge must maintain vis-à-vis the expert, who is thus no longer considered a member of an authoritative elite but a social agent comparable to any other, possibly subject to pressure of a political and economic kind that may impair his discernment. In the *Daubert* decision, judge Kozinski furthermore added a criterion to the first five, namely the question whether the scientific knowledge contributed by the expert had been developed in an independent context of research or rather in one linked with the

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156 This was clarified in the case of *General Electric Co. v. Joiner*, in which the Supreme Court held that questions of method and results could not be totally divorced, because the question of relevance presupposed enquiring to what extent the findings were applicable to the instant case.

157 *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).

158 *"skill or experience-based observation"*.

159 Berger (2000, pp. 31-32).

160 Matters of admissibility of technical evidence are settled in Canada by the *R. v Mohan* judgment [1994] 2 S.C.R. 9. This provides for assessment of (1) the relevance of the technical element in the context of the case being tried, (2) the court's need of assistance, (3) absence of an exclusion criterion (particularly in the light of the Canadian Charter) and (4) the expert's qualification. In the event that the testimony brings new techniques into play, the judgment calls for an assessment of the reliability of the technique according to the 5 criteria proposed in the *Daubert* decision. This precedent was confirmed in *R. v. J.J.* [2000] 2 S.C.R. 600.

case being tried, which might raise doubts about the objectiveness of those involved[161].

Daubert is nonetheless criticised firstly because the criteria proposed are merely surrogates for understanding; secondly because expert opinions are also made up of complex reasoning processes that do not readily fit into such narrow confines[162]; thirdly because of the active role which it gives the judge, who must enjoy a minimum of scientific competence[163], and lastly because the freedom allowed to the judge generates legal uncertainty, since in a given territory judicial rulings may be divergent. In an opinion dissenting from the *Daubert* decision, Judge Rehnquist furthermore condemned this rule requiring each judge to become an *"amateur scientist"*[164]. Following its publication, the NRC report (2009) is expected to have an impact on future decisions, and even court practice, regarding admissibility (Edwards, 2010).

b) The United Kingdom

Expert scientific evidence is generally deemed admissible in English law if it fulfils four conditions:

1) it concerns a subject exceeding the ordinary knowledge and experience of whoever must decide the case;
2) it concerns a subject in a field of knowledge which is sufficiently well organised and recognised to be considered a reliable source of knowledge, a field of which the expert in question has special knowledge that could assist the court in its task;

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[161] This requirement was subsequently challenged on the ground that forensic sciences had no applications outside the judicial context and thus were never really dissociated from an aim of criminal prosecution (Beecher-Monas, 2007, p. 10). This contention may nevertheless be qualified: a method of identification developed in a context of fundamental research should logically have greater credence than a test improvised to conform to the case in point.

[162] Black, Ayala, Saffran-Brinks (1994, pp. 732-733).

[163] An American study shows that while 91% of the judges questioned (out of a total of 400 magistrates distributed throughout the territory and belonging to state courts of 1st instance) considered it quite within their jurisdiction to rule on the admissibility of a piece of evidence and that *Daubert* gave them useful guidelines for this, the concepts of falsifiability and error rates were properly understood by only 6% and 4% respectively (as against 90% correct answers concerning the two other criteria of *peer review* and *general acceptance*). See Gatowski et al. (2001). Admittedly, however, these results do not tell us about the practical application of these concepts in actual cases.

[164] *Daubert*, 509 U.S. at 601 (Rehnquist, C.J., concurring in part and dissenting in part).

3) the expert must have acquired through study or experience sufficient knowledge to render his opinion useful to the court[165];
4) the expert must be impartial.

Concerning the second criterion, the only one of interest in the context of this presentation, English Common Law at present has no well defined rules (along *Daubert* lines) for determining *a priori* the scientific admissibility of evidence[166]: the judge decides at his own discretion whether the evidence affords adequate guarantees of scientific reliability and is relevant[167]. If so, it will rest with the jury to make a determination on the reliability of the method *in concreto*. Some writers criticise this state of affairs on the ground that it effectively saddles the defence with the burden of proving the unreliability of the scientific evidence adduced by the prosecution[168].

In practice, if the expert is accredited or has the necessary qualifications and the subject on which he offers to testify is relevant to the case before the court, his testimony is generally admitted[169]. In sum, the Common Law rejects expert evidence based on charlatanism (astrology for example), accepts "well-established" methods, and lays down the dual requirement of relevance and reliability for the other types of expert submissions (ie most of them)[170]. On the latter point, the *Law Commission* acknowledges that there is no guideline to help judges settle the question of admissibility, and that in practice a "laissez-faire" attitude prevails, with only *"patently unreliable"* methods being excluded [171]. The *House of Commons Science & Technology Committee*[172] considered this situation unsatisfactory and advocated laying down objective, clearly defined criteria to determine the reliability of a technique, which it thought should be modelled on the criteria evolved by the US Supreme Court in the *Daubert* decision.

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165 These first three criteria are criteria laid down by the *Supreme Court of South Australia* in judgment *R. v. Bonython* (1984, 38 SASR 45, 46,47). Some have likened the 2nd stated condition to the US *Frye* standard. The Law Commission, however, diverges from this position (Law Commission, p. 19-21). In Redmayne's opinion (2001, p. 95), the 3rd criterion stated here is, in English law , the closest approach to a stipulation that expert evidence be reliable.

166 Such a *"gatekeeper"* role was moreover denied to the judge by the Court of Appeal in decision *R. v. Luttrell* [2004] EWCA Crim 1344 (The Law Commission, 2009, p. 18).

167 These two elements are the necessary criteria for allowing an expert opinion on a given subject (*R. v. Dallagher* [2002] EWCA Crim 1903 para 29; *R. v. Luttrell* [2004] EWCA Crim 1344 para 37). The evidence is deemed relevant if it can be of any help in determining the case (*R. v. Turner* [1975] QB 834).

168 Redmayne (1997, p. 1046) and references given.

169 Alldridge (1999, pp. 154-155)

170 Law Commission (2009, pp. 21-22).

171 Some recent cases discussed in the case literature, such as *Dallagher* and *Clark*, are not unconnected with this reform movement.

172 House of Commons Science and Technology Committee (2005, pp. 75-77).

The recent work of the *Law Commission*, still under discussion, sought to identify the best way of determining the reliability of a scientific technique and also the reliability of the conclusions drawn by the expert in a specific case. At the conclusion of its study, it proposed four possible solutions[173], giving its preference to a criterion of admissibility requiring the judge himself to decide on the reliability of the evidence, which thus corresponds to the solution recommended in the *Daubert* decision. Recognising the limitations of this approach, the *Law Commission* recommends that this model of "gatekeeping" by judges be adopted nonetheless, chiefly because it appears more realistic to assign this function of evaluating scientific reliability to judges than to leave it in the hands of the jurors.

It further proposes that the criteria for determining the admissibility of scientific evidence be as follows[174]:

- The expert's opinion is admissible only if sufficiently reliable;
- The party wishing to submit an expert's opinion bears the burden of proving its reliability;
- The evidence is sufficiently reliable if[175]:
  (a) based on sound principles, techniques and assumptions;
  (b) these principles, theories and assumptions have been properly applied to the case; and
  (c) the evidence follows from those principles, theories and assumptions as applied to the facts of the case.

In order to establish these various criteria, the *Law Commission* proposes that the following questions be taken into account[176]:

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[173] Discretionary decision of the judge with (1) or without guidelines (2), generally accepted criterion in the scientific community (3), criterion of scientific reliability based on the judge's assessment (4).

[174] Law Commission (2009, p. 50).

[175] The original text is as follows (The Law Commission, 2009, p. 50):
(a) the evidence is predicated on sound principles, techniques and assumptions;
(b) those principles, techniques and assumptions have been properly applied to the facts of the case ; and
(c) the evidence is supported by those principles, techniques and assumptions as applied to the facts of the case.

[176] The original text is as follows (The Law Commission, 2009, p. 53 ss.):
"In determining whether scientific (or purportedly scientific) expert evidence is sufficiently reliable to be admitted, the court shall consider the following factors and any other factors considered to be relevant:
(a) whether the principles, techniques and assumptions relied on have been properly tested, and, if so, the extent to which the results of those tests demonstrate that they are sound;
(b) the margin of error associated with the application of, and conclusions drawn from, the principles, techniques and assumptions;

- has the method used been tested and, if so, to what extent do the results substantiate that the method is reliable?
- what are the method's error rates?
- is there a body of scientific literature relating to the method in question?
- has the method been subjected to peer review; to what extent is it regarded as reliable?
- what are the qualifications, experience and standing of the expert in the scientific community; has he produced publications on the subject?
- is there an opposing position in the scientific community; what are the qualifications, experience and standing in the scientific community of the persons holding these opposite views?
- are there indications that the expert has acted in breach of his duty of impartiality?

It nevertheless adds that implementation of the *Daubert* criteria in the United Kingdom would necessitate the following ancillary measures:

- a judge might, by way of an exception, in very difficult cases, appoint an expert to assist him; the expert's role would be confined to helping the judge determine the reliability of an expert's opinion but not to comment on the actual object of the expert appraisal;
- adequate training for magistrates called upon to apply these new criteria;
- a system of accreditation for experts, allowing the justice system to guard against certain unreliable types of evidence.

The indirect effect expected to be achieved by these measures is to encourage prospective experts to adopt high standards in order to facilitate their possible formal admission before the courts.

(c) whether there is a body of specialised literature relating to the field;
(d) the extent to which the principles, techniques an assumptions have been considered by other scientists – for example in peer-reviewed publications – and, if so, the extent to which they are regarded as sound in the scientific community;
(e) the expert witness's relevant qualifications, experience and publications and his or her standing in the scientific community;
(f) the scientific validity of opposing views (if any) and the relevant qualifications and experience and professional standing in the scientific community of the scientists who hold those views; and
(g) whether there is evidence to suggest that the expert witness has failed to act in accordance with his or her overriding duty of impartiality."

The Law Commission proposes analogous criteria for assessing experience-based rather than strictly scientific evidence (p. 57).

c) Continental legal systems

Contrary to US law especially, continental legal systems often have nothing to say about the scientific criteria to be met by evidence if it is to be deemed reliable and thus given a part in the search for truth, or they settle the question so concisely that it is hard to imagine how the principle will be applied in a specific case[177].

For instance, Article 244 II of the German *Strafprozessordnung* simply provides that *"das Gericht hat zur Erforschung der Wahrheit die Beweisaufnahme von Amts wegen auf alle Tatsachen und Beweismittel zu erstrecken, die für die Entscheidung von Bedeutung sind". (In order to discover the truth, the court shall take evidence ex officio from every fact and proof that is relevant to the judgment)*. Under the terms of Article 427 (1) of the French Code of Criminal Procedure, offences may be determined by any mode of proof "that can establish the truth"[178]. In Swiss law, finally, the scientific admissibility of evidence is governed by a principle to say the least abstract: *"The criminal justice authorities shall employ all lawful types of evidence which, in the current state of scientific knowledge and experience, are apt to establish the truth."* (Article 139 (2) CPP/Switzerland). In practice the situation is regulated unsystematically, traditional types of evidence being admitted because they always have been (and, so it is believed, because of their long-proven reliability), while calls for expert testimony concerning "outlandish" subjects are rejected. In borderline cases the judge will appoint the expert and decide as to the probative value of the expert testimony according to the intelligibility of the report and in the light of the other facts of the case.

Formally, in countries of the inquisitorial tradition, the question of scientific reliability is thus confused with the actual assessment, that is the question of how much probative force to assign to the various pieces of evidence adduced. There is no test of admissibility as such. That probably has something to do with the procedural arrangements in these countries, where professional judges and the duty to give reasons for decisions are seen as an adequate safeguard against the taking of unreliable and irrelevant evidence[179].

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[177] There are, however, a number of exceptions: the Netherlands Court of Cassation (Hoge Raad, January 27, 1998, NJ 1998, 404) issues some general rules on assessment of scientific evidence: an assessment of the theoretical soundness of the technique, of its reliability in being applied, and the expert's qualifications. In Poland too, the Supreme Court invites judges to consider the degree of certainty permitted by the technique and its methodological quality (Girdwoyn & Tomaszewski, 2010). The method is expected to be recognised not only in specialist circles but also among the scientific community in the broad sense. Moreover, the application of the method should be circumscribed by recognised operational procedures implemented by an institution recognised by judicial bodies.

[178] Stefani, Levasseur & Bouloc (2006, p. 109).

[179] Langbein (1977, p. 69).

It is therefore plain that magistrates are left to their own devices in taking these decisions, with the risk of disparate practices developing, of unreliable evidence being admitted, or new methods being rejected when they may be perfectly capable to serving justice.

However, this issue has to be seen in relation to the expert's position in proceedings. These systems typified by a "laissez-faire" attitude towards admissibility are precisely the ones where the trust placed in the expert by the court is greatest, since these systems are also the ones which make the greatest use of officially appointed experts. When these various elements are combined, one finds oneself in a system where the position of the defence is extremely precarious: the judge has complete confidence in the expert whom it has appointed since the expert is presumed impartial and competent, the expert testimony need not undergo any formal test of admissibility, it is presumed correct because all players in the criminal justice system regard science as infallible, and the material and intellectual resources of the defence in this respect are limited. To cap it all, and this will be the subject of the next chapter, assessment of the strength of scientific expertise is a problematical step and there is every reason to believe that at present it is not handled in the best possible way.

5.4. Who should determine the scientific admissibility of evidence?

Is a judge the most competent person to determine the scientific admissibility of evidence?

Although a large body of legal and scientific literature post-dating *Daubert* urged lawyers to acquire training in the assessment of scientific evidence, this wish is unrealistic. Contrary to widespread belief, there is no single scientific method which if properly understood would enable a lawyer to understand all the scientific evidence placed before him. Science is a conglomerate of diverse methods that defy reduction to a few criteria calling for yes/no answers. Unlike law, science functions by degrees and it is all a question of relevance to the legal issues of the specific case.

A number of factors argue against entrusting judges with the task of determining the reliability of scientific evidence[180]:

- Judges are not in a position to decide whether a given body of knowledge constitutes a science (it is a question of epistemology or philosophy of the sciences);
- if it is for judges to settle questions of admissibility, this may cause disparity of practice and legal uncertainty (unpredictability of decisions);

[180] Alldridge,(1999, p. 156 ff.); Alldridge (1992a).

- it may unduly prolong proceedings if a judge must continually address the same questions over again, or questions already settled elsewhere;
- (above all under an accusatorial system) advocates of a new technique may have substantial financial interests in its acceptance by the courts and commit a great deal of money to that outcome, thereby placing the defendant in a rather uncomfortable position.

We therefore feel that both the "laissez-faire" attitude of inquisitorial systems and the method of asking magistrates to assess a list of scientific criteria are both unsatisfactory solutions in that they do not guarantee sound use of scientific evidence in criminal proceedings.

6. Assessing evidence, and more specifically scientific evidence

6.1. Courts' discretion to assess evidence

The European Convention on Human Rights does not include the principle that courts have discretion to assess evidence, but it applies in every European country. This means that the courts are not bound by a legal hierarchy of types of evidence and that the law does not lay down in advance their evidential value[181]. An absence of evidence does not prevent a conviction[182] and equally the existence of certain types of evidence does not lead automatically to a guilty verdict[183].

Courts are therefore free to make their own decisions, which means that they can base them on any relevant evidence and are not bound by the requirement of rationality - in other words the obligation to abide by the rules of formal logic and technical and scientific rules[184] – and the prohibition of arbitrary

[181] Certain forms of evidence are considered to be correct until shown to the contrary. This applies, for example, to certain reports prepared by sworn officers under French law (Dervieux, 2002, p. 263).

[182] There are however exceptions to this principle because in certain legal systems some evidence must be corroborated.

[183] However, there are certain exceptions: for example in British law if the accused opts to plead guilty the court must convict, even if the judge believes otherwise (Spencer, 2002b, p. 196). In other systems there are also irrefutable presumptions as a result of which once evidence is adduced a certain state of affairs is taken to be established. For example, under Article 2.2 of the Swiss road traffic regulations, a certain level of alcohol in the blood as established by a blood test requires the Swiss courts to find automatically that the individual concerned is incapable of driving a vehicle.

[184] For Swiss law, see Müller (1992), pp. 66 ff ; Verniory (2000), pp. 393-396. For German law, see Huber (2008), p. 292.

decisions. They may or may not have to give reasons for their decisions, depending on the system.

Although forensic evidence is theoretically subject to the principle of the courts' discretion to assess evidence[185] and should therefore be critically assessed, the day-to-day practice of the courts may be somewhat different. Given such previously mentioned factors as confidence in experts and gaps in judges' scientific knowledge, consideration should be given to how much weight such evidence really carries in satisfying the court.

6.2. Assessing scientific evidence

It goes without saying that all those involved in preparing technical evidence, whether as part of the preliminary inquiries, the judicial investigation or the trial phase, must operate within strict practice guidelines. There are now clear rules governing the analytical part, with almost systematic use of accredited protocols, often based on ISO standard 17020. For example, the Council of Europe's 1992 Recommendation R (92) 1 on DNA testing lays down welcome and strict rules to ensure that laboratories carrying out such analyses satisfy certain technical requirements. Recent European Union recommendations, such as Council Framework Decision 2009/905/JHA of 30 November 2009 on accreditation of forensic service providers carrying out laboratory activities, are also concerned with DNA profiling and fingerprint data. Other areas of forensic science are moving in the same direction in Europe and the ENFSI (European Network of Forensic Science Institutes) has made an important contribution to drawing up good practices, through its working groups. The ENFSI urges all its members to seek accreditation. In 2007 (Malkoc & Neuteboom, 2007), nearly 40% of laboratories affiliated to the ENFSI were accredited; the current figure is nearly 70%.

While it is important for courts to be reassured that forensic sciences are based on good practices and protocols it has to be said that the high standards that are applied to analyses do not extend to the way the results are interpreted and expressed in expert reports (Willis, 2009). There is no specific standard under ISO 17025 on the drafting of expert reports or the presentation and communication of the results to the judicial authorities. Yet how results are interpreted and communicated to the courts is of fundamental importance. Not only must forensic scientists have the requisite technical and analytical skills, which is generally the

[185] There are sometimes limits to the principle. In Switzerland, for example, the courts are free to assess expert evidence as they see fit but must give reasons for their decision if they decide not to accept an expert's conclusions. The established case-law is that courts can reject expert evidence if it is inconsistent or is based on facts which differ from those established in the pre-trial proceedings, or when two experts differ in their opinion.

case, but they must also develop the capacity to interpret the relevant data (Fereday & Kopp, 2003).

As several writers have noted, there is no single body of rules on interpretation (or terminology) common to all the forensic community. Following the Guy Paul Morin case, the Kaufman commission (Kaufman, 1998) looked at these issues in great depth. In his study of genetic analysis as part of forensic evidence, Verhaegen (1997) was already stressing the need for all laboratories to have effective protocols and systems for interpreting results. According to Garrett and Neufeld (2009), numerous errors of communication can lead to a poor assessment of the significance of technical aspects of a case. Walker & Stockdale (1999, pp. 148-149) conclude their own study: "Thus, there remain problems, especially about the standards employed in analysis and the soundness of the interpretation of results, with the grave danger that the jury will be seduced by the purity of the science without fully considering the impurity of its applications".

The NRC (National Research Council, 2009) report also drew attention to the dangers of using tendentious, or even fallacious, terminology, to the extent that its authors felt the need to make a specific recommendation on the subject.

Legal systems currently apply the principle that courts have discretion to evaluate evidence, sometimes after cross-examination. There is a paradoxical element here, since courts acknowledge the limits to their technical knowledge by appointing experts, while retaining the right to reject the latter's conclusions if they consider this necessary. In technical areas in particular, courts have no other option but to rely on an expert, though this may be tested in cross-examination, or to choose between two different expert opinions, according to criteria that remain obscure. Yet the courts' freedom to form an opinion on the facts implies that they will apply the principle of rationality and transparency in their decision-making. Simply delegating responsibility to an expert is not compatible with this principle. Such delegation currently causes problems because experts do not use a uniform terminology in their reports and when they are questioned, and because what they say is often partial and only presents the prosecution's case or, at best, is open to several interpretations or even a systematic overestimation of the contribution of the technical component.

We see opportunities for recommendations on the drafting of expert reports from the specific standpoints of how to assess the value of the information, the terminology to be used and how to formulate conclusions. These could help to harmonise European practice, irrespective of the judicial system concerned[186]. Interpreting technical evidence is not an easy task for either scientists or lawyers, This is because it takes place at the interface of two worlds

[186] Dr. Sheila Willis, Director of the Irish Forensic Science Laboratory, has recently been awarded ENFSI funding from 2010 to 2013 to look at these issues and make relevant proposals.

with very different intellectual backgrounds. Several years ago Robertson and Vignaux published what is considered to be the best work on the subject, aimed at judges (Robertson & Vignaux, 1995). Aitken and Taroni (Aitken & Taroni, 2004) offer a more statistical form of approach. We would offer three basic principles for interpreting scientific evidence (Champod & Evett, 2009):

1) The scientific element must be interpreted in the light of the circumstances of the particular case. Experts must have a certain amount of information about the case in question so that the results obtained and their interpretation can be put in context;
2) A rational and balanced interpretation of the scientific element is only possible if the results are assessed in the light of both the prosecution and defence cases;
3) The questions that the technical expert must answer are always concerned with the probabilities associated with the technical results obtained (having regard to the respective prosecution and defence cases) and not with the probabilities of the cases themselves[187].

The first principle means that technical experts must be informed at the right moment of the respective cases of the prosecution and defence. Following various judicial errors in Britain, the 1993 report of the Royal Commission on Criminal Justice (Roberts & Willmore, 1993) called for closer communication between experts and the parties. Under the second principle expert reports would present results that took account of all the hypotheses advanced, irrespective of which party had commissioned the expert. This means that experts working for the prosecution should still be informed of the defence case in order to secure the necessary balance. The same applies to experts appointed by the court or the defence. The third principle establishes precise terminological rules for the conclusions of expert reports and their presentation to the courts[188].

The recent AFSP UK and Ireland (Association of Forensic Science Providers, 2009) standards lay down a number of important principles on the drafting of expert reports and statements, including:

- the need for an explicit evaluation of the forensic results in relation both to the facts alleged by the prosecution and the case submitted by the defence. This evaluation must be conducted on the basis of a formal and transparent logical framework;
- experts' ability to present the scientific bases of their analyses;

[187] Otherwise the technical expert would be making the mistake of "prosecutor's fallacy" or "inversion fallacy" (see footnote 35) or offering evidence which included more than just an assessment of the scientific elements.

[188] More specific recommendations are made by Evett *et al*. (2000).

– the need for experts to document, and report, the various stages of their work and the reasoning behind their conclusions.

The Barry George case highlights the benefits of such standards. Barry George was convicted in 2001 of the murder of the journalist Jill Dando. The prosecution evidence included textile fibres from the victim's raincoat which matched Mr George's trousers[189] and a particle of firearms discharge residue found in the suspect's pocket nearly a year after the murder. At the first trial the discharge residue was described as "consistent" with the hypothesis that it came from the weapon used to kill Miss Dando[190]. The appeal followed a review by the Criminal Cases Review Commission (CCRC) of the strength of the forensic evidence. The CCRC suggested that work undertaken by the Forensic Science Service (FSS) on interpretation should serve as the new means of assessing forensic evidence. It was this work that formed the basis of the AFSP standard referred to above.

When the plausibility of the results was assessed in a balanced manner, taking account of the defence as well as the prosecution cases, it emerged that the discharge residue found in Barry George's pocket could be equally explained with his having fired the shot (the prosecution argument) or not having fired it (the defence case). In other words the recovery of the discharge residue was essentially neutral and did not make it possible in any way to support either of the arguments put forward. The evidence was not useful information for the court and its presentation at the first trial, with the use of the term "consistent", was likely to give it undue evidential value. As a result, the court of appeal eventually overturned the first judgment[191]. In preparation for the second trial, the discharge residue was deemed to be inadmissible evidence. Barry George was finally acquitted in August 2008. Had there not been a reassessment of the strength of this evidence, based on the principles of balance and transparency, he may still be in prison.

7. Issues for discussion and conclusions

The literature consulted has identified a number of ways of improving the presentation of expert opinions to the courts. Here, we will put forward some of those that appear to offer the most promise, whether the system is basically accusatorial or inquisitorial, based on the principle that the process will benefit from the maximum possible transparency for all those concerned.

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189 The fibre evidence was to play a relatively minor part in the case.
190 The weapon used to fire the fatal shot was never found.
191 *R. v. Barry George*, UK Court of Appeal, [2007] EWCA Crim 2722.

Preparing the expert evidence

- *A greater defence input*

  Throughout the period of preparation of expert evidence and as early as possible in the proceedings, the parties should be able to interact with the expert in a transparent fashion. The parties should not be authorised to be present when the scientific tests are being conducted, since this might interfere with the smooth running of the operation, but they must be allowed to submit working hypotheses that the expert should take into account. We are emphasising here the role of the defence, but naturally experts must also receive appropriate information from the prosecuting authorities[192].

- *Court-appointed experts*

  Many lawyers and scientists operating in accusatorial systems see the notion of court-appointed experts as a miracle solution. We are more sceptical, since experience shows that such experts generally work more with the criminal prosecution authorities than with the defence, and the latter often find it difficult to find an alternative expert of equivalent status. Moreover, the neutrality of court-appointed experts gives them *de facto* a privileged status in that they have the almost total confidence of the court. Add to this the fact that in inquisitorial-type proceedings, there is no "culture" of questioning the word of experts, since defence lawyers have the impression that this could be seen by judges as criticising their choice and therefore be counter-productive for the defence case. Such a system does not therefore contribute to a critical assessment of expert reports and is not sufficient, we believe, to ensure that scientific evidence will receive a rational appraisal[193].

  We do, however, see advantages in employing court-appointed experts to assist courts to assess complex issues involving conflicting evidence

[192] As Roberts and Willmore (1993, p. 137) state, after analysing 27 sets of forensic evidence, "Our research suggests that the superficially attractive objective of shielding the forensic scientist from information which might inappropriately influence her scientific judgment should be abandoned in favour of more productive efforts to improve the extent and quality of the information exchange between FSS scientists and instructing lawyers."

[193] The Auld report (1991) presents similar arguments against proposals to increase the number of court-appointed experts in the United Kingdom's accusatorial system.

presented by the parties. This is the compromise advocated by Patenaude (2003, pp. 170-171) in Canada.

- *Pre-trial conferences and joint expertise*[194]*, and multiple expert witnesses (hot-tubbing)*[195]

  Joint expertise is where different experts whose conclusions are likely to diverge meet outside of the court to identify areas of agreement[196] and then submit to that court only evidence that is still the subject of debate. This saves time by only presenting to the courts contested items of evidence, and also helps the defence because each expert is forced to assess the other's point of view[197].

  Joint hearings of experts, or so-called hot-tubbing, means that all the experts are heard in court at the same time. Each presents his or her findings in turn and can then comment on what the others have said. The judge and the parties have an opportunity to ask questions, and the whole process continues informally so that points of agreement and disagreement can be clearly identified.

  Such approaches are attractive, but are only significant when the parties or the authorities have commissioned several experts, whose conclusions differ. This does not resolve the problem of how to assess expert evidence when only one expert has been called – which is often the case with inquisitorial proceedings – and no one challenges his or her conclusions.

- *Give precedence to written reports*

  Since scientific evidence is often very complex, it is much easier for the parties to understand, even in countries using the accusatorial system, when it comes in written form, setting out the steps in the process and the findings. It may also be worth encouraging the use of visual aids such as photos and diagrams to back up written or oral explanations.

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[194] See Part 33, Rule 33(5) of the Criminal Procedure Rules (United Kingdom), following the Auld report (1991). In an accusatorial system this may have the disadvantage that counsel will lose control over their experts. However, the Court of Appeal has recently referred to the benefits of this system in R. v. David Reed and Terence Reed, R. v. Neil Garmson, UK Court of Appeal, [2009] EWCA Crim 2698 and R. v. Weller, [2010] EWCA Crim 1085.

[195] For more on this subject see Edmond (2009).

[196] For example, they may agree on the way to explain a certain technology, a demonstration of certain phenomena, a glossary of key terms or a chronology of certain events (Sommer, 2009).

[197] Roberts (1994, p. 492).

Finally, in the interests of transparency, experts should be asked to make their laboratory notes available to the court and the parties (even if they are not made a formal part of the case-file, as in inquisitorial proceedings) during the procedure and when they give evidence in court[198].

Assessing expert evidence

- *Standards of interpretation*

  There should be a standard for the scientific interpretation of results to serve as a guide to the framing of expert reports, the terminology to be used and how conclusions should be expressed. It should be disseminated both among experts and the courts, with appropriate training.

- *Making lawyers more aware of the fallibility of expert evidence and the notion of interpretation*

  A good understanding of scientific evidence depends less on the criteria that are adopted than on the willingness of courts to assess critically the material presented to them. Significant efforts must be made to make all those involved in the judicial system fully aware of the weaknesses of forensic reports. However well developed a technique may be, it still has to be applied by humans and errors are always possible. The parties must be aware of this and adopt a critical approach to such reports and the courts must also be conscious of the need to give proper weight to such evidence.

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[198] Still, in the interests of transparency and to facilitate assessment of experts' work, their reports should include the following:
– the expert's qualifications: training, accreditation and experience;
– an exhaustive account of the information and documents received by the authority, or where appropriate by the parties;
– a detailed description of the operations and procedures carried out;
– the identity and qualifications of the assistants who have helped the expert to produce the report, and a description of their tasks;
– any theoretical disagreements in the relevant field, and the personal position of the expert and the reasons for this position;
– a discussion of the findings, in terms of alternatives put forward;
– the expert's conclusions;
– useful illustrations and references;
– a statement that the expert was informed of his or her procedural obligations, such as professional confidentiality and the consequences of producing an inaccurate expert report.

But experts' work does not end with the reading of their analytical findings. The significance of scientific evidence in any particularly case is always subject to interpretation and this cannot be placed within the close confines of an ISO accreditation. When the evidence is taken it has be seen in the general context of the case and there has to be close communication between the expert and the court to ensure that the former provides the latter with useful information and that the latter does not form an exaggerated opinion of the expert's conclusions.

This has to be seen in relation to court-appointed experts. It is not sufficient for the court to rely on the confidence it has in its expert. Nor do joint expert reports and joint hearings of experts offer any solution to this problem.

Supra-national approaches

- *A scientific evidence assessment committee*

One possibility might be to establish a European body on the lines of the British Forensic Science Advisory Council[199] and Forensic Science Regulator[200] to act as the main adviser to political and judicial authorities on the reliability of the scientific techniques that are used. This is the position adopted by Alldridge (1992b) following his analysis of DNA evidence. In line with technological developments, certain forms of scientific evidence come to be seen by those involved in the judicial field as almost infallible. The more a particular form of scientific evidence is deemed, of itself, to be critical, the more necessary it becomes to subject it to the rigorous assessment of an independent body.

Such a body would not have binding powers, but could nevertheless issue recommendations to domestic courts that would assist judges when they had to rule on the admissibility of a new forensic technique or the reliability of a new form of evidence, or when it seemed appropriate to abandon a form of evidence that had become obsolete. Such a procedure would take time, which would be quite welcome to certain figures who consider that the judicial system should keep its distance from "cutting edge scientific discoveries"[201]. As Patenaude pointed out (2003, p. 180),

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[199] This body was set up in 1993 on the recommendation of the Runciman report (1993), which followed a number of judicial errors in Great Britain.

[200] http://www.homeoffice.gov.uk/police/forensic-science-regulator/

[201] Alldridge (1999).

the idea is not a new one. It was indeed included in the statutes of the International Academy of Criminalistics, founded in 1929.

- *An international panel of experts*

  As we have seen, the number of experts that the courts can call on is often limited. The result is that in any particular geographical area it may be difficult to find an expert who specialises in the field in question and therefore impossible to find an expert for the defence, or simply a private scientific consultant, in the same field and with the same level of experience[202]. It would undoubtedly improve the situation if domestic courts could call on the services of other European experts[203]. The aim would be to establish a European register of experts with its own machinery for registering individuals and recognising laboratories, to ensure that there was a sufficient number of experts available in the increasingly varied fields of forensic science.

- *Code of Ethics*[204]

  A European ethical code for all forensic experts would have particular symbolic significance. It might require those concerned:
  - to perform their duties in a neutral and impartial fashion, on behalf of the court rather than either of the parties;
  - to take account of all relevant information in carrying out their work;
  - to describe clearly the facts and observations on which their opinion was based and report any gaps in the initial data that made it impossible to reach any definitive conclusions;
  - to refuse to reply to questions that fell outside their sphere of responsibility, or which only the court was competent to answer;
  - to advise the court immediately of any change of opinion on the substance of their conclusions, after reporting to or being heard by the court;

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[202] This issue was raised in the *Eggertsdottir v. Iceland* judgment. The applicants had questioned the independence of the experts commissioned by the Icelandic government, which had responded that inevitably, given the size of the country, the medical experts representing both sides would work in the same hospital.

[203] In 2000, Jakobs and Spangers noted that securing experts for the defence was a problem in the majority of European systems and called for a European list of experts .

[204] See Meintjes–van Der Walt (2003, p. 99).

– to provide the court, on request, with their personal notes and any other documentation relevant to the case.

Saks (1989) provided an overview of ethics codes that existed at the end of the 1980s. The need for such a code of ethics was also one of the specific recommendations of the *National Research Council* (2009) report. The ENFSI also has a code of conduct[205] that includes some of the aforementioned elements. It simply needs to be made more generally applicable.

The increasingly significant advances in the field of scientific evidence are posing fresh challenges to domestic legal systems because of the additional problems they raise in terms of equality of arms, and more specifically the ability of the defence to call on the services of forensic experts of the same standard as those available to the criminal prosecution authorities.

We believe that this calls for a thorough review of the law on how scientific evidence should be presented and evaluated by the courts. Given the speed with which forensic techniques are evolving and the day-to-day constraints on the activities of the courts – lack of time, material resources and personnel and the range of cases they have to deal with – it is unreasonable to expect judges, prosecutors and counsel to reach a conclusion on issues that are still sometimes the subject of debate in the scientific community itself. We are conscious of strong pressure to adopt criteria similar to the *Daubert* standard to determine whether scientific evidence is admissible[206]. We have reservations about such an approach. The guidelines laid down in the *Daubert* decision have some merit but they place a considerable burden on judges who completely lack the technical knowledge to apply them properly. We believe that some of the avenues previously explored offer more effective ways of dealing with the challenges of forensic science for the criminal justice system.

One final lesson is provided by the early use of DNA in the courts. If DNA analysis is now considered to be a highly safe forensic technique, this is because in the 1990s the courts, and in particular defence lawyers, put great pressure on forensic experts and the prosecution authorities who employed them. Much effort went into improving their practices and demonstrating that it was a reliable technique before this form of evidence was deemed admissible. Yet in many other areas, forensic experts have failed to address their own shortcomings and the courts should no longer accept evidence whose reliability has not been established. The criminal justice system is forensic science's one and only client and it must therefore insist on a product that fully matches its needs[207].

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[205] http://www.enfsi.eu/page.php?uid=43

[206] This is particularly the case with the Law Commission (2009).

[207] As Faigman (1999, p. 82) puts it: *"The law is a consumer that receives only as good as it demands."* See also (Thompson, 1997; DeCoux, 2007, p. 135).

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