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Anna IBEK*
Monika SUCHOJAD

THEORETICAL BASICS OF SCIENTIFIC EVIDENCE IN CRIMINAL PROCEEDINGS

Summary
The paper is a theoretical consideration on the scientific evidence in a criminal proceeding, presented as following: the explanation of the term "scientific evidence", the review of the existing definitions of scientific evidence (i.e. by methodological, methodical and normative enumeration), a proposal of a general, classic definition of the scientific evidence. It also shows criteria to identify the "correctness" of the scientific evidence, from inter-subjective controllability and communication, validation of the test method, interpretation of the results of its application with the use of a likelihood ratio, up to a critical analysis of Frey's standard and Daubert's standard. The paper concludes with a discussion on selected concepts of the scientific evidence assessment for the purposes of criminal proceedings.

Key words: *scientific proof, test method, standard, validation.*

Introduction

The aim of this paper is to consider the term "scientific evidence", particularly: (1) an analysis of already existing concepts of the scientific evidence and a proposal of the best way of understanding the term "scientific evidence", (2) establishing of characteristics and features of the scientific evidence, (3) establishing of methodological and logical criteria to identify "correctness" of the scientific evidence, (4) establishing the rules and the way of evaluating the scientific evidence for the purposes of criminal proceedings. It should be emphasized that the issue of the scientific evidence in the specified areas is relatively

* Anna Ibek MA, an assistant and doctoral student of the Department of Forensic Science, Criminology and Police Sciences at Andrzej Frycz Modrzewski Kraków University; Monika Suchojad MA, a doctoral student at Andrzej Frycz Modrzewski Kraków University.

complicated, often ambiguous, and primarily it is interdisciplinary, somewhere among the theory of a criminal proceedings, general methodology of science and logic, forensics and other disciplines (e.g. genetics). The last one should be associated with the identification techniques of people and things, which are part of forensic sciences. For these reasons, the presented consideration cannot "claim right" to a complex elaboration of theoretical basics for the scientific evidence, but they only explain this issue from the perspective of the four mentioned areas of knowledge.

1. Explanation of the term "scientific evidence"

Let us start with the explanation of the components of the term "scientific evidence". The interpretation of the word "evidence" in the discussed context does not seem to be significantly problematic[1]: "evidence" means "proof". Evidence is the information that meets two conditions. First of all, the information must be appropriate as a prerequisite for court proceedings in the evidence reasoning in a given case. Secondly, the information must be relevant for the resolution of the case. Evidence reasoning is a thought procedure which involves the acknowledgment of *factum probandum* (opinions on factual evidence), on the basis of *factum probans* (opinions on demonstrative facts). More broadly, it can be stated that these are thought procedures that happen when interpreting factual findings, which involves (1) the acknowledgement of some factual evidence on the basis of demonstrative facts or (2) generating the hypotheses on the basis of the known factual or demonstrative evidence or (3) the test of hypotheses, also on the basis of the known factual or demonstrative evidence.[2] The relevant evidence is associated with, following R. Kmiecik, the evidence *...which may be "useful" in practice (relevant evidentially) for establishing the substantive facts*[3].

It is worth noting that regardless of the type of context, whether it is legal or only empirical, the information involved in the evidence

[1] It should be stated that the theory of a criminal procedure involves several concepts of "evidence". For the purposes of this paper the most common and standard meaning of this term has been taken into consideration.
[2] Ibidem.
[3] R. Kmiecik (ed.), *Prawo dowodowe. Zarys wykładu*, Kraków 2005, p. 113.

reasoning (the evidence itself as well) has three fundamental features: apart from the mentioned relevance, it consists also of credibility and the power of evidence, although it does not constitute the evidence itself. It becomes the evidence when it is used for argumentation, reasoning or the chain of reasoning, thanks to which, apart from the conclusion, it is possible to identify the sources of uncertainty or doubtfulness when assessing the credibility, relevancy and the power of evidence[4]. It should be remembered that this evidence is of special nature, because it is aimed at assessing the facts, not establishing them, as the rule says.[5]

Much more complicated and also a crucial problem is understanding of the "scientific nature". The attempt of solving it by a reference to some "demarcation line" between science and non-science is generally impossible due to lack of a clear criterion related to a prospective course of this line.[6] What remains is a reference to some minimum (and relatively uncontroversial) set of requirements that allows the specified terms to be considered scientific[7], and acceptance of the fact that the scientific nature, which is typical for those terms, is gradable. In other words, some terms may be more or less scientific than others (e.g. due to a different level of the methodological advancement of a given discipline). As a minimum set of requirements in the theory of criminal proceedings and forensics, for a long time[8] there have been considered inter-subjective communicability and controllability of terms[9]. In other words, firstly, those are terms that may be expressed with words comprehended literally, i.e. without metaphors, comparisons and other

[4] M. Suchojad, *Sieci wnioskowań*, (in:) J. Konieczny (ed.), *Analiza informacji w służbach policyjnych i specjalnych*, Warszawa 2012, p. 43.

[5] M. Ilnicki, *Dowód z opinii biegłego w postępowaniu apelacyjnym w procesie cywilnym*, Edukacja Prawnicza, 2013, no 4, p. 16.

[6] J. Konieczny, *Metodologiczna charakterystyka kryminalistyki*, Katowice 1984, p. 15.

[7] E.g. according to the definition by D. Caudill&Lewis Laure*: science is a product which arises through combination of observations and experiences in real conditions as well as norms, conventions and expectations of the scientific circles*. As cited in: D. M. Risinger, *The Irrelevance, and Central Relevance, of the Boundary between Science and Non-Science in the Evaluation of Expert Witness Reliability*, (in:) P. Roberts (ed.), *Expert Evidence and Scientific Proof in Criminal Trials*, Farnham 2014, p. 117-118.

[8] Some authors see the origins of these requirements in rationalism of enlightenment. See: K. Ajdukiewicz, *Zagadnienia i kierunki filozofii. Teoria poznania. Metafizyka*, Kęty-Warszawa 2003, p. 49.

[9] J. Konieczny, op. cit., p. 16–17; M. Zieliński, *Poznanie sądowe a poznanie naukowe*, Poznań 1979, p. 130 – 143.

half measures of expressing thoughts. Secondly, only such a statement may "lay claim to the scientific title", the fairness or unfairness of which actually everyone can become aware of, provided that this person is confronted with appropriate environment.[10] Another difficulty arises, bearing in mind that characteristics of scientific nature may be assigned to an activity or a result of this activity. Scientific proof as a statement (therefore – a certain result), which considers a single fact does not belong to science[11], provided that forensic sciences belong to nomothetic science.[12]

The remaining thing to consider is the act that brings the result. This act may be treated as a method (a way of conduct). Does a test method have a scientific nature? Yes, and it will be confirmed by numerous arguments, legitimising the existence of a scientific method. Having noticed that the method may be defined – like the statements – inter-subjectively communicable and inter-subjectively controllable, there can be no objection to the acknowledgement that the scientific nature assigned to a specified method is also gradable, like in case of the statements. The starting point for further consideration are the following observations. The scientific proof is the forensic evidence that is:

- the information that may be applied as a prerequisite for a court proceeding in the evidence reasoning when establishing factual findings in a criminal proceeding,
- the information is significant in a specified case,

[10] K. Ajdukiewicz, op. cit., pp. 49 – 50.

[11] An interesting issue often discussed in literature is the correlation between science and law. For example, D. Nelken puts it this way: the relationship of science and law should be considered in three different concepts: 1) the attitude of the trial pathology which allegedly considers multi-functionality of legal proceedings system and private proof in the proceedings; 2) approach of competing institutions which regard law and science as strong and often competing entities, which in many areas require close co-operation and symbiosis; 3) approach of conflicting discourses developed by theoreticians of continental system who base their divagations on inquisitive model of the process and the rule of appointing experts by court according to which (discourses) there is a discrepancy between science and law, because on one hand, legal system uses the scientific legacy (for example the issue of scientific credibility), and on the other, law and science continually compete with each other and each strive for its own (better ?) hybrid solutions. D. Nelken, *A Just Measure of Science*, (in:) P. Roberts (ed.), op. cit., pp. 26-28.

[12] J. Konieczny, op. cit., p. 44.

- the source of the information is a legal expert,
- the level of its scientific nature is determined by the features of the method that has been used by the legal expert to obtain the information.

It should be noticed that the first two points relate to every evidence, the next one refers to all experts' reports in general, and the last point, however it is understood, is specific to the scientific proof. Therefore, it is the method by which the scientific proof (as information) was obtained. As a result, it is already known that the method must meet the conditions of inter-subjective communicability and controllability.

2. Defining the scientific proof

The increased interest in the issue of the scientific proof dates back to the 1980s. and 1990s.[13] Due to several reasons, including gross judicial mistakes, revealing extreme negligence of the assessors, and others, a quality breakthrough in the criminal expertise took place, and one of the goals of the implemented changes was the end of "guerrilla" of experts' work.[14] It was rightly concluded that imposing strict, scientific, methodological requirements on the expertise will improve the situation.

There are different definitions of a scientific proof. The simplest trials of defining is enumeration, which indicates specified pieces of evidence as parts of fields of certain sciences. An example of such a definition is a list that covers: biological and chemical evidence, fingerprints, motion traces, traces of tools used, traces of firearms, and contested documents. The decision on acknowledgement of the results of such a test is on the court's side, which governed by certain standards, admits the given evidence (see below).[15] Generally, this definition is

[13] In late 1990s the model of Case Assessment and Interpretation (CAI) was introduced, and later (in 2009) a report from activities of National Academies of Science on strengthening of the position of scientific proof in the United States was published, what caused a considerable interest in the notion of scientific proof and this interest resulted in a considerable amount of valuable scientific output which arose particularly on the common law tradition. U. Simmross, *Appraisal of scientific evidence in criminal justice systems: on winds of change and coexisting formats*, Law, Probability and Risk, 2014, 13 (2), p. 105.

[14] D. Dwyer, *Judicial Assessment of Expert Evidence*, Cambridge 2008, p. 232.

[15] Such solution is propagated by: L.R. Netzel, T.F. Kiely, S. Bell, Evidence: *Origins, Types, and Admissibility*, (in:) S.H. James, J.J. Nordby, S. Bell (ed.), *Forensic Science.*

acceptable. However, a strong objection is evoked by considering certain fields of knowledge as scientific. These are: dactyloscopy, traceology or forensic graphology. Moreover, the indication of a specified expertise as scientific proof, taking into consideration only its admissibility, is not fully satisfactory.[16]

The scientific proof may also be characterized by defining through postulates. A proper example may be a set of requirements aimed at the expert's method, which should be described and validated and its application should be under control so that every properly trained expert obtains the same results, within the known level of the method's restrictions.[17] In other words, the method may be controlled by its description, known results of validation, training and authorisation of the personnel who apply the method, as well as the maintenance of the essential equipment, its calibration, the use of proper comparative materials, definite and familiar way of the results interpretation, the results check, carrying out of the test by competent experts and finally the perpetuation of the test results, including the printouts generated by the apparatus.[18] However, these are not the only remarks, because apart from the requirements related to the method, the cited authors formulate numerous further conditions relating, e.g. the quality of the laboratory procedures, general training of experts, security and storage rules of the test material, the form of reports, details on the particular areas of expertise etc., therefore one can talk about defining through postulates.

The basis of the reasoning in the course of expertise should be scientifically justified generalisations[19] i.e. general statements, considered true, entitling to conclusions in a particular direction

An Introduction to Scientific and Investigative Techniques, Boca Raton 2014, pp. 31–35.

[16]Similarly i.e. through enumeration of the scientific proof is defined by: E.J. Imwinkelried, *The Methods of Attacking Scientific Evidence*, New Providence 2014.

[17] B. Caddy, P. Cobs, *Forensic Science*, (in:) P.C. White (ed.) *Crime Scene to Court. The Essentials of Forensic Science*, Cambridge 2004, p. 13. It is worth noticing that this approach is almost identical to the approach of J. Konieczny (as cited by J. Kmita). See: J. Konieczny, op. cit., p. 17.

[18] B. Caddy, P. Cobs, op. cit., pp. 13–14.

[19]One example of such generalisation is a quote from the printing studies: *accuracy of UZCT-DLT technology in tests amounts to 92%*. See: A. Ibek, *Generalizacje w rozumowaniach dowodowych*, Studia Prawnicze. Rozprawy i Materiały, 2012, nr 1 (10), p. 54.

(speaking figuratively, from a prerequisite/prerequisites for court proceedings to the conclusion, so called evidence-based argument of the expert's opinion).[20] Such generalisations may be well-justified scientific statements, a consequence of rules of some science, they may also be the result of the expert's professional experience, provided that the experience has its source in the scientific knowledge.[21]

Others postulates, which seem crucial, related to the scientific proof were formulated by Ch. Champod and I.W. Evett. The authors do not refer to the admissibility or controllability of the evidence but its interpretation. Their proposals are as follows: (1) The scientific proof must be interpreted within the frames determined by the circumstances of the case. The expert formulates a hypothesis, the probability of which is dependent on (relevant) factors, which influenced the formation of the test material. There may be included e.g. the type of surface from/to which the micro traces were transferred, the choice of the data base in case of establishing the matching of DNA profiles (if the origin of the suspect is known), or other circumstances related to the trace. (2) The scientific proof may be interpreted with two statements, and speaking more strictly: at least two statements. In other words – there should be competitive research hypothesis formulated, one accordant with the content of the indictment act (the accused is the culprit), and the other which is contradictory to the first one (the accused is not the culprit). Only in such cases it is possible to identify properly the probability of both hypotheses (if there are more than two required, the case becomes more complicated, but the sense of establishing of the probability remains the same). (3) It is essential for the author to consider the questions like: what is the probability of the evidence in case of acceptance of a given hypothesis?. The answer is given by calculation and submitting to the court the credibility quotient, the crucial value specific to the scientific proof.[22]

[20]Generalisations used in evidence reasoning may have various origins e.g. they may come from personal experiences of the subject of reasoning, from general knowledge accepted in a given community etc., they may also come from science. On the topic of generalisation see: T. Anderson, D. Schum, W. Twining, *Analysis of Evidence*, Cambridge 2005, p. 262 and next.

[21] Ibidem, p. 270.

[22]Ch. Champod, I.W. Evett, *Evidence Interpretation: a Logical Approach*, [in:] A. Jamiesson, A. Moenssens (eds.), *Wiley Encyclopedia of Forensic Science*, Chichester 2009, Vol. 2, pp. 971–972.

For obvious reasons there is no space here for explaining the meaning of the credibility quotient, which is not specific to the forensic science anyway. For the purposes of this paper it is sufficient to acknowledge that the credibility quotient is the ratio between "a chance of guilt" *a posteriori* and "a chance of guilt" *a priori* or in other words, it is the factor that indicates how many times more one of the hypothesis is probable, formulated in the test, against the competitive hypothesis.[23]

It is difficult to deny the legitimacy of the presented postulates of Ch. Champoda and I.W. Evetta. Equally, it would be difficult not to notice that they are suggestions highly inflated. They eliminate from the list of scientific proofs all the expertises, which so far have not had the calculation of the credibility quotient in their areas of knowledge. Generally, this is no loss, and it is better to accept the fact that e.g. the traceological or cheiloscopy expertise nobody will be able to title a scientific proof, due to the difficulty in assessing the probability *a priori* of a hypothesis.

It is worth mentioning the invention – if not a solution, then a circumventing at least – of a mentioned problem. The expert transfers the establishing of the output probability *a priori* to the court. The expert prepares proposals of a certain value as various options, and the decision is left to the court. For example, a possibility that the culprit is an unknown resident of the town *A* (where the crime was committed) is X_1, the culprit is a resident of the county *B* (where A is located) is X_2, the culprit is a resident of the voivodship *C* (where B is located is X_3, etc). The expert submits the justification for each of the presented possibilities, but the credibility quotient is calculated after indicating which of the output possibilities should be taken into consideration. The expert may also calculate this figure for each of the analyses variants, but leaving the decision on the use of one of them to the court.[24]

There is another argument - against the acknowledgement of calculating the credibility quotient as a fundamental aim of the scientific

[23] In Polish literature more on this topic see: P. Wolańska- Nowak, *Interpretacja wyników ekspertyzy*, [in:] J. Wójcikiewicz (ed.), *Ekspertyza sądowa. Zagadnienia wybrane*, Warszawa 2007, pp. 576–580.

[24] D.H. Kaye, *Interpretation*, [in:] J.A. Siegel, P.J. Saukko (eds.), *Encyclopedia of Forensic Sciences*, Amsterdam 2013,Vol. 1, p. 137. Practical issues related to presentation of probability calculus in court are discussed in: M. Redmayne, *Expert Evidence and Criminal Justice*, Oxford 2004, pp. 57–93.

proof – in some cases the knowledge of its level is unnecessary for the court. In case of the mentioned so called CAI model of expertise (*Case Assessment and Interpretation*), created in order to rationalise costs of the expertise and reduce unnecessary work of the expert, the purpose of a detailed assessment of the aims of the expertise is forecast. It turns out that actually most of them, but not all, require the calculation of the credibility quotient. Particularly, these are the ones that, according to the expert, are aimed at explanation of some issues, especially those concerning the investigative decisions (which may refer to e.g. the cause of death, the course of a road accident, a tax fraud mechanism etc.).[25] Should such expertises be "automatically" excluded from the set of the scientific proofs? It seems they should not, but it requires a reduction of the requirements defined Ch. Champoda and I.W. Evetta, possible to accept without a loss for the scientific level of the expertise (see below).

It is worth adding that in literature there are some interesting explanations aimed at simplifying the comprehension of the relatively complicated issues of the scientific proof, through taking up particular actions spread over time. Therefore, U. Simmross divides those actions into: (1) short-term: improving of the legibility of the experts' opinions, concentration on the establishing of the probability instead of dogma, interest of potential members of the trial in the scientific proof through inviting them to debates or co-editing of the papers; (2) medium-term: improvement of the education and implementation of trainings, clarifying the terms and concepts in the field of Bayes' theory, searching of new multidisciplinary PT (*proficiency tests*) and CE (*collaborative exercises*) concepts[26]; and (3) long-term: extending – at the level of school education – the scope of consideration on the reasoning models, analysing the similarities and differences in terms of the assessment of the evidence in various countries, taking advantage of the statistics acquis with the reduction of the statistical assistance in the criminal proceeding at the same time.[27] It seems that activities of this type – but others also –

[25] G. Jackson, P.J. Jones, *Case Assessment and Interpretation*, [in:] A. Jamiesson, A. Moenssens (eds.), *Wiley Encyclopedia of Forensic Science*, Chichester 2009, Vol. 2, pp. 495 - 496.

[26]Generally speaking, proficiency tests and collaborative exercises are control and certification procedures of experts. See for example: J. Hebenstreit, *Zapewnienie jakości w laboratoriach sądowych*, [in:] J. Wójcikiewicz, op. cit., p. 597.

[27] U. Simmross, op. cit., .p. 111.

may be beneficial socially, at least due to the fact that recently there have been a lot of discussion on the lack of proper competence and qualifications of experts, which may be caused by an easy access to the function, because of the insufficient legal regulations.[28] As J. Wójcikiewicz rightly states: *...the propagation of the Daubert's standards (see more below) among Polish judges (but also experts!) could only be a benefit for the Polish judicial system*.[29]

3. The accessibility of scientific evidence

For many years the discussion on scientific evidence has been dominated by the problem of its accessibility, the criteria of which determined its scientific nature. There are two criteria; they have their genesis in judicature of the American courts and are known as *Frey's* standard (test) and *Daubert's* standard (test).[30] If an expertise "passed" the test, then it was accessible in the trial and obtained the status of a scientific proof. The central point of the *Frey's* standard was establishing if "scientific rules and discoveries", used in the expertise, obtained "the general approval in the area they belonged to".[31] Seventy years later the judicature in the *Daubert's* case was more extended and covered the following issues, as the conditions of the expertises accessibility: testability (or falsifiability) of the applied knowledge by the assessor, the knowledge of the mistake level of the method applied in the expertise (the diagnostic value of the method), its previous (in relation to the time of the expertise) description in the review science literature, and also analogically like in case of the *Frey's* standard, the general acceptance of the applied knowledge in the expertise.[32]

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[28] E. Gruza, *Fakty i mity, czyli kilka słów o zbrodni doskonałej*, Edukacja Prawnicza, 2014, no 11, p. 11-13. The issue on entitlements and qualifications of experts was also discussed by: J. Wójcikiewicz, *Temida nad mikroskopem*, Toruń 2009; J. Widacki (ed.), *Badania poligraficzne w Polsce*, Kraków 2014; J. Wójcikiewicz (ed.), *Iure et Facto*, Kraków 2006.

[29] J. Wójcikiewicz, op. cit., p. 23.

[30] The names refer to two cases: Frye v. U.S. (1923) and Daubert v. Merrell Dow Pharmaceuticals (1993). More in:. D.L. Faigman, M.J. Sacks, J. Sanders, E.K. Cheng, *Modern Scientific Evidence. The Law and Science of Expert Testimony*, Eagan 2010–2011 Edition, Vol.1, p. 4.

[31] Ibidem, p. 8.

[32] Ibidem, p. 43. It should be added that after the judgement in Daubert case, some courts and court commentators had more remarks in addition to the original four, which should

Both mentioned standards were broadly discussed in literature, but they did not solve the matter of accessibility (and also the concept) of the scientific evidence. This was caused by two reasons. Firstly, the considered standards show a strong "flexibility", which led to the formation of four approaches: (1) *Daubert* - rigorous, (2) *Daubert* – liberal (*permissive*), (3) *Frey* – rigorous, and (4) *Frey* – liberal.[33] Secondly, it turned out that particular American courts considered the role of judges in *screening* of the opinions of experts differently. Some of them took an active role in the *screening* of the evidence, while others were involved only a little or at all.[34]

It may be stated that neither Frey's standard nor Daubert's, despite their great global significance, did not bring a possibility of emerging a clear definition of the scientific evidence. Moreover, it may be noticed that nowadays the consideration of those standards gain a historical nature. With the answer to the Daubert's case the American legislator implemented in 2000 amendments to the Federal Evidence Rules and the rule 702, significant to the concept of the scientific proof obtained an interesting meaning: "If the scientific, technical or other specialised knowledge will support the jury (*trier of facts*) in comprehending or establishing of the evidence, then the witness called as an expert (…) may testify (…), if (1) the testimony is based on sufficient facts or data, (2) the testimony is the result (*product*) of reliable rules and methods, and (3) the witness applied the rules and methods reliable in relation to the facts in the case."[35] It should be stated at the same time that the reliability is considered here as infallibility and repeatability of the results.[36]

Apart from the mentioned Daubert's and Frey's standards a significant role in terms of the assessment criteria of the scientific proof was played by "the precedented statement of the Dutch Supreme Court of 27 January 1998, issued on the basis of a traceological expertise (…)

facilitate the decision on inadmissibility of evidence. See: D.L. Faigman, M.J. Sacks, J. Sanders, E.K. Cheng, op. cit., p. 17 and next.

[33] Ibidem, p. 3.

[34] Ibidem, p. 3.

[35] As cited in: E. Beecher-Monas, *Evaluating Scientific Evidence. An Interdisciplinary Framework for Intellectual Due Process*, Cambridge 2007, p. 4.

[36] This infallibility has nothing in common with the rule of infallibility of the criminal proceedings in Polish legal system (fair trial or due process*)*, nor with the Anglo-Saxon understanding of the rule of infallibility. See: P. Wiliński (ed.), *Rzetelny proces karny w orzecznictwie sądów polskich i międzynarodowych*, Warszawa 2009.

[which] established (…) some standards of the assessment of the evidence through the expert's opinion: if the expert is an expert in their field, what methods they use and why they claim that those methods are sufficiently credible; if they are qualified enough to use those methods competently."[37]

4. Towards general definition of scientific evidence

Summarising this part of considerations i.e. an attempt to define scientific evidence, it should be noticed that the notions known so far are arrived at in four different ways: calculation, methodological, methodical and normative. The calculation method was excluded from the analysis as theoretically futile. In methodological aspect the most important seems to be the issue of inter-subjective controllability and communication of the research method, in methodical aspect - the issue of interpretation of results of the expertise; in normative aspect - the problem of admissibility of evidence. These aspects are not separable. The main consequence of the last remark is possibility of acceptance the requirements of rule 702 in its contemporary wording are embraced by two preceding aspects: methodological and methodical. Summing up, the most important methodological requirements are:

- inter-subjective controllability of the method applied in the expertise and inter-subjective communication of results,
- using in inferences generalisations formulated on the basis of accurate empirical research;
- methodical requirements –
- interpretation of expert research results within the circumstances of the case,
- in an expertise testing of at least two competing hypotheses,
- formulation of final conclusions of the expertise together with the likelihood ratio.

The set of these requirements may be treated as an early definition of a scientific evidence. However, there are prospects for making further generalisations with special emphasis on the research method as the most

[37]As cited in: J. Wójcikiewicz, op. cit., p. 8.

constitutive element of scientific proof. In order to exploit these prospects one should turn to the notion of the quality of the expertise.

To assure high quality of the expertise it is necessary to meet a whole range of requirements related to work in laboratory, qualification of experts, applied procedures which are regulated by ISO norms. The question of method in international standard is under the requirement that: *full validation of all technical procedures is necessary before they are applied in particular cases or internal verification of procedures validated earlier in other laboratories*.[38] Fundamental significance of the validation should be emphasised. It may be understood (in the most concise meaning) as *...statistical determination of method parameters conducted in order to confirm that it is suitable to be applied in specific objectives*.[39] It should be noticed that the validation of the method gives way to determination of the likelihood ratio.

5. General definition of scientific evidence

The search for general definition of scientific evidence may be summarised using a classical definition in the following way: scientific evidence is an expertise (*genus*) conducted by means of a method which meets all assumed quality criteria (*differentia specifica*). In this context the element of relativisation of the concept of scientific evidence to legislative body. In this case the justification comes from court ideology called in Polish legal system principle of free appraisal of evidence. Admission and evaluation of expertise belongs to the legislative body and, at least theoretically, one can imagine a situation in which a court, on one hand, admits a tacky expertise and, on the other, rejects a professionally prepared one. The court may overlook the validation of the method, level of error or standardisation and settle for unreliable and dubious opinion like *the author of the manuscript x_1 is person A*[40], but the court may also enquire about a number of other issues such as: how many times is the hypothesis *the author of the manuscript x_1 is person*

[38] A.R.W. Jackson, J.M. Jackson, *Forensic Science*, Harlow 2008, p. 12.
[39] W.J. Tilstone, *Assuring Quality in the Crime Laboratory*, [in:] A. Mozayani, C. Nozigilia (eds.), *The Forensic Laboratory Handbook*, Totowa 2006, p. 221.
[40] The main opponent of the principle of forensic individualisation in Polish literature seems to be J. Konieczny. See: J. Konieczny, *Kryzys czy zmiana paradygmatu kryminalistyki ?*, „Państwo i Prawo", 2012, z. 1 (791), p. 3 – 16.

A more probable than *the author of the manuscript x_1 is not person A*, taking into account circumstances of a given case.

In acceptance by the legislative body of certain qualitative criteria lies the essence of scientific evidence. One should remember however, that these criteria are not polar, their division is not dychotomic what stems from the thesis of gradability of scientific extent of a given process. Thus, maybe it would be a good idea to harmonise criteria which determine identification method as being scientific or unscientific through creation of a universal, widely accepted catalogue of qualitative criteria which could assist court in the process of evaluation of a given evidence. A good example in this respect may be the activities of European Network of Forensic Science Institute (ENFSI) which focus on *propagating among all member laboratories the principles of good practice and international standards assuring high quality of research and competences of persons conducting them*.[41]

6. General criteria of evaluating scientific evidence

Observations and conclusions presented above in an obvious way impact the solution of the problem of methodological and logical criteria that condition accuracy of scientific evidence. Most of all, these criteria, in practice, must be individualised. It is a consequence of a well-known old truth that there are no general rules that determine the strength of evidence in particular cases (to be more specific they exist but on the grounds of legal principle of evidence evaluation which in Polish criminal proceedings do not occur). J. Bentham in 1825 wrote that *finding infallible rules for evidence, rules that secure relevance of particular decisions is, by nature, absolutely impossible*[42]. Nevertheless, there are certain proposals concerning general criteria for evaluation of scientific evidence.

One of the proposals seems to be the most complete as it offers a general concept of evidence analysis.[43] This proposal consists of five elements: (1) identification and examination of the theory proposed for explanation of occurrences, evaluation of the impact of explanation for the hypotheses built on the grounds of the theory; (2) examination of data

[41] J. Widacki (ed.), *Kryminalistyka*, Warszawa 2012, Edition 2, p. 194.
[42] As cited in: T. Anderson et al., op. cit., p. 226.
[43] E. Beecher-Monas, op. cit., p. 1.

which support or undermine the proposed theory; (3) formulation of assumptions which support the theory in the context of obvious gaps between data and the theory; (4) examination of the method which was used to conduct the expertise; (5) evaluation of probability which links the hypotheses with data that exist in the case. This concept deserves approval as it embraces all conditions discussed above which are put on scientific proof. An inquisitive reader may also notice that no expertise based on traditional forensic comparative research will pass the test prepared by E. Beecher-Monas.

Other conditions for accuracy of scientific evidence are proposed by P.G. Giannelli and E.J. Imwinkelried.[44] In their opinion reliability of evidence depends on three factors: (1) the level of theory validation; (2) the level of research technique validation; (3) appropriate application of this technique in particular case. It should be added that the authors understand validation as the ability to measure the value it is supposed to measure and identify it with precision. While infallibility, in their opinion, is the repeatability of results of the same measure by means of the same method. It should be noticed that such concept of validation is not divergent with the approach of W.J. Tilstone presented above, as it comes down to provision of statistical profile of a theory or method. The authors do not reveal what level of theory validation is satisfactory to be applied in scientific evidence. However, at the moment it does not constitute a major problem as it is the mere significance of paying attention to the importance of validation that really matters. The authors write though that satisfaction of the third condition depends on the set of tools used by an expert, application of appropriate procedures and sufficient qualifications both of the expert and reviewer of the obtained results.[45] One can risk a statement that remarks of P.G. Giannelli and E.J. Imwinkelried should be treated as reference to the modern standards with respect to the quality of expertise.

Conclusions

With the knowledge of some methodological basics of issuing court opinions and awareness of general methodology of sciences one may, without much difficulty, formulate various lists of criteria for

[44] P.G. Giannelli, E.J. Imwinkelried, *Scientific Evidence*, Newark 2007, Vol. 1, p. 2.
[45] Ibidem, p. 3.

appropriateness of scientific proof. The criteria can be general but they can also be 'customized' for the needs of a particular expertise and from the point of view of the process side interested in the results of the expertise. Two issues seem to be out of any dispute: (1) the pre-origin of all questions on accuracy of a scientific proof is the fact that 100% reliable research methods do not exist, the main problem with scientific evidence is thus coping with uncertainty. There is no other segment of knowledge apart from science which would better define uncertainty. The question is not whether science should be present in court but rather what science should it be; (2) the recipe for success of scientific evidence does not exist either if this success is to be understood as admission and approval of the expertise. The success always depends on the level of aspirations to take certain decisions by the legislative body, and the level of aspirations is, in turn, shaped by knowledge and experience of the legislative body, by professional standards that exist in the legislative body's professional environment. It is also known that the level of criteria may be, and in reality frequently is, higher or lower, what in reality translates into success or failure of a given scientific evidence in criminal proceedings.

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