Presentation of Forensic Science Evidence

Dr. Ran B. Singh,
Forensic Science Laboratory, Lucknow - 226 006,

Forensic science evidence can be broadly classified into scientific evidence - when the results of scientific experiments/observations are expressed without further interpretation; and expert evidence - when the conclusions drawn (opinion) are expressed on the basis of the interpretation of the results of scientific experiments/observations. Let us consider the case of drug analysis. A questioned sample is analyzed by appropriate analytical methods, following the standard procedures, and the results of the analyses reveal a specific drug in the sample. The results of such analysis are conclusions based on well-established scientific principles and standard procedures. Hence, the findings need not be interpreted further if only the identification of the drug is required. The test result, by itself, is the evidence of the presence of the drug in the sample and meets the purpose of enquiry by the court. This evidence can be used as such in the judicial process of decision making. Such evidences may be classified as scientific evidence. On the other hand, when the question regarding source correspondence between two or more samples or individualization of a sample is to be answered by the forensic scientists, the results of the scientific experiments, observations, and measurements on the samples are assessed and compared to draw rational and balanced inferences. This process known, in general, as interpretation, makes use of the analytical results in forming the opinion to meet the purpose of the enquiry by the court. In addition to the relevant database and other specific information on the samples, the experience and expertise of the forensic scientist plays an important role in drawing such conclusions to express the opinion in the matter. Such opinions, based on the interpretation of the results of scientific experiments/ observations, may be classified as expert evidence.

The comparison of physical properties and chemical profile, and/or the topographical features (striation patterns, marks, impressions, etc.) of the questioned and known samples form the basis of expert evidence. However, the methods and criteria used for comparing the physical properties and chemical profile, and striation patterns, marks, impressions, etc. (topographical features) are distinguishably different. The physical properties and chemical profile (minor/trace composition) of two or more samples are studied using sophisticated and sensitive analytical techniques and the results are compared and assessed to determine if the samples could have originated from one source. Whereas, the striation patterns, marks, impressions on the samples (topographical features) are examined with the help of magnifiers and microscopes of different kinds, to study the class characteristics and individual characteristics present therein. These characteristics are compared and matched to opine on their source correspondence.

As there is no theoretical foundation for the uniqueness of either the physical properties and chemical profile, or the topographical features, except the generalized inherent variability, the best resort is the statistical evaluation of the analytical results/observations. Statistical treatment of data generated on the samples, and making use of the databases for the attributes studied, yield quantitative estimate of the

significance of the scientific findings. The selection of suitable statistical procedure for treatment of the evidence data to estimate its strength would also depend on the judicial requirements for the decision making. The basic question is whether the evidence should be evaluated for the probability of guilt or for the probability of innocence of the suspect, that is, whether we should determine the discrimination potential or the association potential of a given attribute of a physical evidence. The discriminative approach presumes the suspect to be innocent while the associative approach presumes him to be guilty of the crime. Taking ratio of the probability of guilt and that of innocence is another way to look at the evidential value. It may be worthwhile to debate and decide on these issues and adopt, internationally, suitable statistical methods for evaluating physical evidences.

Many forensic scientists have advocated the Bayesian approach to interpretation of forensic science evidences, in the recent years. The Bayes' theorem is widely used in decision making. Bayes propounded that the probabilities should be revised when new information is available. The need to revise probabilities arises from a need to make better use of available information and thereby reduce the risk involved in decision making. In Bayesian interpretation of forensic science evidences, the likelihood ratio is evaluated. This ratio compares the likelihood of two possible hypotheses, which are mutually exclusive. Many forensic evidences have been evaluated with Bayesian perspective and various formal mathematical models have been developed. There is, in general, considerable interest in this method, at present. However, this approach to the interpretation of forensic science evidences is still viewed with skepticism by some people in view of the fact that, some times, the probabilities revised on the basis of additional information may lead to wrong decision.

The forensic scientists should consider different propositions to interpret and evaluate the evidence. However, there exists a tendency for the scientists to express an opinion with regard to the propositions of the side that employs him, and then to respond to the alternative propositions put by the other side. At times, this makes the scientist appear to be partisan to the side that employs him. A forensic scientist should consider the propositions of the prosecution as well as allegations of the defense and present a balanced view of the evidence. An expert may revise his opinion if he finds cogent reason and his evidence need not be disbelieved on this ground.

The scientific evidences are expressed in a straightforward manner. But, most of the expert evidence is a matter of disciplined judgement of the forensic scientist, a subjective judgement based on objective test results. The strength of such evidences should be properly assessed, and expressed carefully in a language, which is clear, concise, unambiguous, understandable, and not open to misinterpretation. The vocabulary used for expressing the value of the evidence should be standardized. It would also be desirable to make clear what the evidence does not mean in addition to what it does.

Forensic Opinion

The modern means of communication are shortening the distances and the criminal, particularly those in the areas of terrorism, drugs and other organized crimes, now move

very fast from one state to the other state. The rulings of the courts on forensic evidence in one state get disseminated faster and affect the evidence put forward by forensic scientists in other states. The importance of coming together on uniformity in the whole forensic process in the country, in order to maximize contribution of forensic science to fair and impartial justice, can not be over emphasized.

The results of forensic analyses and the conclusions drawn upon (forensic opinion) should be expressed in a language, which is clear, understandable and not open to misinterpretation. The vocabulary used to express the strength of physical evidence should be standardized and adopted by all the laboratories in the country. This would reduce the confusion, misunderstanding, and miscarriage of justice caused by misinterpretation of the reports submitted by the scientists from different laboratories and make the forensic science profession more transparent to the legal profession and the general public.

The need for quality in terms of accuracy and reliability and a sound assessment of the strength of the evidence as the benchmark to be adopted by all?

Forensic scientists need to express their conclusions in language, which is clear, understandable, and not open to misinterpretation. Over the years several authors have considered the difficulties of conveying probability estimates verbally to non-scientists. In this paper, statements written by forensic scientists from different disciplines are compared. Even though the statements differ widely because of the different types of analytical work carried out; each may be placed in one of four categories. Ways in which forensic scientists might improve readers understanding of their statements are discussed. There is a need for a dialogue between forensic scientists, police officers, lawyers and the judiciary to try and reduce mutual incomprehension. Clear formulation of the conclusions in words which are both understandable and not open to misinterpretation is perhaps the most difficult part of all Sir Roger Ormrod highlighted one particular difficulty, the need for a forensic scientist to make clear what the evidence does not show in addition to what it does. The authors suggested giving objective measures of certainty when possible and explicitly setting out the scale of qualitative opinions being used when such quantifiable evidence was not available.

Documented and publicized standard scale of words which reflected a Bayesian approach to the interpretation of evidence.

In other cases, it was a matter of judgement for the scientist to determine whether or not two items matched and to what extent. It is difficult, if not impossible, to express such results in quantitative terms and objective measures of the probability of the observed result occurring by chance do not exist.

Clear and concise verbal explanations of conclusions, accompanied by an indication of certainty, where appropriate, are needed. Scientists present oral evidence in only a small minority of cases, so a report will often be read aloud by someone else. Conclusions must therefore be clear without being overstated. If the evidence does not positively exclude a

suspect, the report should not be written in a way which suggests that it does; other evidence might be overwhelming. A Bayesian approach will consider the ratio (the likelihood ratio) of two competing probabilities for the observed results; the probability of the evidence given that the accused is guilty.

That forensic scientists are very bad at making clear what their evidence does not mean. A shoe-mark can show that a shoe was present, but not who was wearing it.

In recent years there has been a major change in the way that scientific results are reported which was intended to make scientific evidence more accessible to other participants in the criminal justice system. There is still room for greater clarity in the way that the scientist's level of certainty is expressed.

If confusion, misunderstanding and miscarriages of justice are to be avoided forensic scientists must explain their findings clearly and unambiguously. They cannot achieve this on their own. Other participants in the criminal justice system need to make an effort to understand scientific evidence and not hide behind the excuse that they were no good at maths at school.

Match criterion which 'must be objective, precise, and uniformly applied. The probability for an event in any non-trivial situation is inevitably conditioned by the assumptions that are made and there is no situation in which one can have a probability without making at least one assumption. This is close to being nonsense unless one itemises the other explanations which might reasonably be considered. A scientist cannot speculate about the truth of a proposition without considering at least one alternative proposition. Indeed, an interpretation is without meaning unless the scientist clearly states the alternatives he has considered.

Weight of evidence is properly conveyed by the use of the word supports together with an appropriate qualifying term. The range of qualifiers that are used can be chosen with reference to the underlying concept of the likelihood ratio. This philosophy point the way to uniform standards for reporting strengths of corroborative opinions throughout the science and in all languages and disciplines.

The essence of forensic science is the drawing of rational and balanced inferences from observations, test results and measurements. This process, which we know as interpretation, is experiencing a steady period of evolution, largely because of the growing body of scholarship based on application of the Bayesian paradigm.

In contrast, there is no corresponding theoretical foundation for the uniqueness of chemical profiles there is only the generalized attribution to variability in geologic and manufacturing processes. Nor is there a theoretical foundation for the uniqueness of tool mark and firearm striation patterns; again, there is the reference to variability in manufacturing processes and the use history of the particular tool or firearm. Practically speaking, there may be little need for a theoretical explanation of the uniqueness of chemical profiles, striation patterns, and many of the other uniquenesses that forensic

science invokes, for there is empirical evidence of variability and the reliable detection of the variability can be demonstrated.

this is a fruitless exercise unless there are agreed upon criteria for making judgements.