The role of the forensic scientist in our legal system

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Adversarial system safeguards justice
One of the greatest safeguards of justice in our courts is the adversarial system which allows both sides of a case to be advanced. Opportunities exist for cross-examination and in this way the real relevance of a testimony can be brought before the court. It is unthinkable that anyone accused of a serious offence would elect to have his own defence counsel. Yet one glaring omission exists in our courts as I see it.

Forensic evidence
Forensic evidence is an important component of many legal issues being contested in the courts today. Yet the only evidence of a scientific nature available to the courts is that provided by the state. The state forensic laboratories provide only access to the various components of the forensic evidence which will be placed before the courts. In many instances the state forensic laboratories provide an excellent service, often under trying conditions. However, I contend that this is not a healthy situation where the forensic evidence is derived from a single source. There are few measurements in science which are so conclusive that only one inference can be drawn. Much of forensic science involves procedures which under certain circumstances can give rise to ambiguities. These ambiguities would only be apparent to one well versed in experimental design and the interpretation of data. These contentions can be illustrated with a few examples.

Blood alcohol determinations
The state for many years used analytical techniques for blood alcohol determination which were sensitive to substances other than ethyl alcohol (the intoxicating component of beverages). In recent years the method of choice has been gas chromatography which can measure ethyl alcohol accurately and specifically. However, this is a sophisticated method and certain prerequisites must be complied with in order that credence be placed on the results. The instruments must be reliably calibrated and internal standards must be included to allow for natural variations in performance of the electronics in the instrument. In one respect the state has lagged behind the technology. This is in the method of collecting blood samples. Samples of blood are taken from a superficial vein and introduced into a bottle which is then sealed and sent for analysis. This bottle contains sodium fluoride and an anticoagulant. The concentration of sodium fluoride is adjusted to be approximately 1%. This was originally suggested as adequate in a paper by Plueckhahn and Ballard in 1968 (Medical Journal of Australia, vol 1 939-943). Sodium fluoride is an enzyme inhibitor and is believed to prevent the subsequent fermentation of the blood by micro-organisms which enter the bottle when the lid is first removed to allow introduction of the blood. Blood contains sugar and is an ideal material in which fermentation could occur with de novo alcohol production.

Recently, however, it has been shown that certain yeasts are capable of multiplying and changing the alcohol levels even in the presence of sodium fluoride (Corry J E L, March J C and Grunwardene R H 1979 J Applied Bact 47(3) ix).

In addition I am of the opinion that alcohol can be produced in the presence of sodium fluoride, as glucose is not the only substance which can give rise to alcohol by microbial action. There are many substances present in blood and tissue which, if subject to microbial action, could give rise to ethyl alcohol. And they can do so independently of the pathway which is inhibited by fluoride.

In addition a proportion of the bottles returned to the state laboratories show evidence of live micro-organisms as contaminants (approximately 35%). The importance of these observations in cases of drunken driving, post mortem blood samples and aviation accidents speak for itself and cannot be underestimated.

In cases involving expert testimony, the framing of a good cross-examination can be enormously facilitated by having a defence expert in court to assist the cross-examining counsel.

Immunological methods
Science and technology have made very rapid strides in the past years and many of these areas concern forensics. Immunological methods have entered the field and are invaluable in such areas as blood grouping, saliva identification and semen stains. It is also important in determining the origin of certain animal remains (i.e. human or otherwise). The reliability of the method requires the specificity of the antibodies used to be established beyond doubt. There are many instances in nature where cross-reaction occurs. For instance the humble micro-organisms which inhabit our bodies and environs have blood group substances virtually indistinguishable from our own.

Other analyses
In civil matters too, the forensic scientist can offer considerable assistance to the legal profession. The analysis of inks can provide valuable adjunct to the document investigator. Careful analysis of paint and glass can aid materially in reconstructing the events in hit-and-run accidents. Ballistics and the analysis of powder stains on garments or skin can provide a link between a firing gun and the ammunition that inflicted it. Also there are various methods in use today to determine whether or not a suspect has recently discharged a firearm. Many of these methods are suspect as they depend upon the presence of certain chemicals on the hand which could be deposited from, say tobacco ash or garden fertilizer.

Expert defence forensic assistance
Although the state provides a good service and an impartial one, the value of expert defence forensic assistance is well illustrated by the Seddon case in England in 1911. The prosecution forensic expert was Sir Bernard Spilsbury. Spilsbury was prepared to admit that on the basis of his autopsy death could have been due to epidemic diarrhoea but he excluded this because of the condition of preservation of the body. Spilsbury ascribed the good state of preservation to the presence of considerable quantities of arsenic in the remains of Miss Barrow. We know, however, that putrefaction proceeds despite the presence of fatal quantities of arsenic and that the good state of preservation may be explained by the physical conditions of the soil in which the body was buried and the state of drainage of the cemetery.

The application of technology to forensic science has increased and it is possible to determine such things as whether a headlight was on or off at the time of an accident. In some instances fragments of glass can be positively shown to originate from a certain window. Fibres from ropes or clothing can be matched with the rope or garment from which they derive.
Toxicology presents a wide scope for the forensic scientist. Methods of isolating and identifying drugs and poisons are sensitive and sophisticated and the presence of drugs in an organ or blood sample can have wide-ranging consequences from civil (insurance waivers) to criminal.

Gas chromatography linked to mass spectrometry can be used to detect minute quantities of various substances and positively identify them. This could be important with substances other than drugs and poisons. The various components of cosmetics lend themselves particularly to this type of analysis.

Another area of interest to the forensic scientist is arson. Invariably traces of the incendiary material remain at the scene of the crime. These may easily be detected. In addition fires behave in predictable ways and this is often overlooked by the arsonist who, intent on his crime, forgets that evidence will remain despite the destructive effects of the fire.

It appears that in South Africa private forensic services are not easily available and in many cases appearing before our courts forensic advice and consultation could play a vital role in seeing to it that justice is done.

Notice

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