

Letters to the Editor

Discussion of "Expert Testimony and Scientific Evidence in Arson-Related Cases"

Dear Sir:

I read with great interest the article by S. B. Kantrowitz, "Expert Testimony and Scientific Evidence in Arson-Related Cases" (Vol. 26, No. 1, Jan. 1981, pp. 142-152). I found the article to be a very fine overview of the analysis and testimony relating to fire residues. I did, however, find one passage within the article quite odd. On p. 148 the author states that the gas chromatogram produced by an accelerant such as gasoline "looks as though a person had traced the outline of his fingers on a piece of paper. (Because of the physical resemblance, many chemists refer to the chromatograph results as the chemical 'fingerprint' of the substance being tested.)"

I would agree that many chemists refer to the output of some instrumental techniques such as gas chromatography and infrared spectrometry as "fingerprints." But I do not agree that the reason this is so is the physical resemblance of the graph to the human hand. I would submit, instead, that this unfortunate comparison is made to endow the peaks and valleys of a chromatogram (or spectrum) with the individualizing qualities of fingerprints. The strong implication is that as distinct fingerprints represent unique entities, so do sufficiently detailed and complex chromatograms (and spectra).

This sort of comparison is unfortunate for several reasons. First, variations in instruments, sample preparation, and operating conditions and the presence of contaminants in chromatography and spectrometry cause too much variation from sample to sample of the same material for tests to be as reproducible as fingerprints. This is especially true in the case of chromatograms of fire residues. Secondly, in the case of infrared spectra, the spectra of enantiomers (for example, *d*- and *l*-cocaine) are so similar as to be indistinguishable. Thus an infrared spectrum does not represent a unique entity.

This problem of the use of the term "fingerprint" may seem to be trifling but the imprecise use of such terminology can lead to problems in court, especially in the realm of expert testimony. I might point out that the term "identical" is another often-misused word in the lexicon of forensic science. The term is used to denote a high degree of similarity between two objects, as in "the stria in the two bullets were identical." In fact, no two objects can ever be identical (exactly alike); they must differ in some measurable way because of their unique existence.

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Author's Reply

Dear Sir:

Essentially, Professor Siegel disagrees with my statement that many chemists call the gas chromatograph the chemical "fingerprint" because the graph looks as though one's hand had been traced. I maintain that many chemists do make this simple analogy. It is entirely possible, as Professor Siegel asserts, that some chemists use the fingerprint analogy to denote uniqueness. If this is so, I agree that it is an unfortunate comparison.

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Discussion of "Isoelectric Focusing in Agarose"

Sir:

In his article [1], Dr. Burdett states, "Sample 10 in Fig. 1, classified as a 1+1-, shows the typical storage band that has a pI intermediate between b- and b+ isoenzymes and is not to be confused with the c, d, e, and f bands" for which he references Sutton [2].

I have experience in analyzing samples for phosphoglucomutase (PGM) subtype by isoelectric focusing using both Ampholine pH 5-7 and Pharmalyte pH 4-6.5 carrier ampholytes. In my experience the c+ and c- bands are as described by Sutton (anodal to the 2+) band with Ampholine but located on either side of the 2+ band when focused with Pharmalyte (Figs. 1 and 2).

Additionally, when only a 1- isoenzyme is present, when focused with Pharmalyte, the second band between the 2- and 2+ band is present (Tracks 12 and 13, Fig. 2), but in

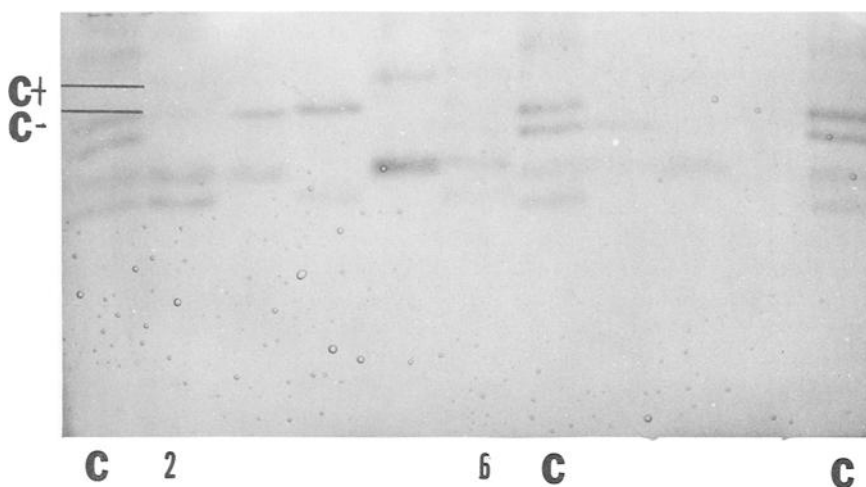


FIG. 1—In PGM subtyping with Ampholine pH 5-7 carrier ampholytes, the c+ and c- bands described by Sutton [2] are anodal to the 2+ band in the 1+1- samples (Tracks 2 and 6). Tracks labeled C are controls containing all four PGM isoenzymes.

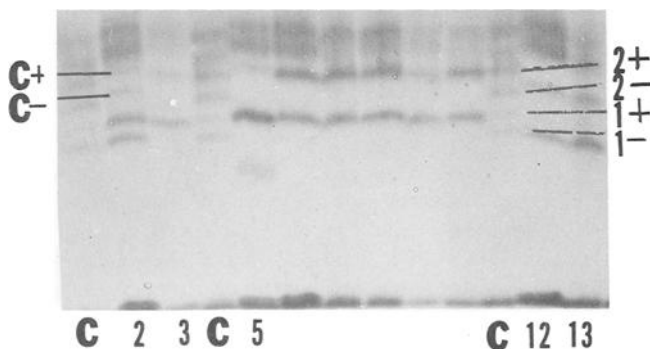


FIG. 2—In PGM subtyping with Pharmalyte pH 4-6.5 carrier ampholytes, the c+ and c- bands surround the position of the 2+ band in the 1+1- samples (Track 2). Tracks labeled C are controls containing all four PGM isoenzymes.

those samples with a 1+ isoenzyme the second band present is anodal to the 2+ (Tracks 3 and 5, Fig. 2).

Therefore I believe that the "storage" band described by Dr. Burdett is in fact the "c—" band and the next anodal band observed in the 1+1— samples in his Fig. 1 is the "c+" band.

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References

- [1] Burdett, P. E., "Isoelectric Focusing in Agarose: Phosphoglucomutase (PGM Locus 1) Typing," *Journal of Forensic Sciences*, Vol. 26, No. 2, April 1981, pp. 405-409.
- [2] Sutton, J. C., "Characterization of the Isoenzymes of Phosphoglucomutase (PGM) Determined by the First (PGM₁) and Second (PGM₂) Locus Observed by Isoelectric Focusing," *Human Genetics*, Vol. 47, No. 3, 1979, pp. 279-290.

Author's Reply

Sir:

The hypothesis presented by Mr. White is an interesting one, and the location of the minor components, the c, d, and e isoenzymes, should be precisely determined. Because the band in question is not always visible, it has been widely regarded as a storage product, and an isoenzyme that in no way compromises the determination of the PGM phenotype.

Although the isoenzyme patterns obtained on starch gel electrophoresis and isoelectric focusing (IEF) can be correlated by excising bands from one system, followed by running them again on another (as used by Sutton [1]), a simpler and more elegant approach would be to separate the various isoenzymes according to their pH mobility curves [2,3]. Essentially this technique is a very simple modification of conventional IEF. Once the pH gradient is generated (as usual, by the carrier ampholyte), the sample is applied as a streak across the pH gradient and the gel is subsequently electrophoresed at *right angles* to the first dimension. The resultant pattern is essentially the titration curve of the protein (or isoenzyme) under test. Therefore for PGM the pattern generated at zero mobility should be the pattern observed on IEF, whereas the pattern observed at pH 8.4 should be that which is seen on conventional electrophoresis. The correlation between the two patterns should then be immediately apparent.

At this stage it is too early to comment further on the implications of Mr. White's hypothesis other than to stress that whatever the origins of this isoenzyme, it in no way comprises the identification of the PGM phenotype.

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References

- [1] Sutton, J. G., "Characterization of the Isoenzymes of Phosphoglucomutase (PGM) Determined by the First (PGM₁) and Second (PGM₂) Locus Observed by Isoelectric Focusing," *Human Genetics*, Vol. 47, No. 3, (1979), pp. 279-290.

- [2] Rosengren, Å., Bjellqvist, B., and Gasparic, V., "A Simple Method for Choosing Optimum pH Conditions for Electrophoresis," in *Electrofocusing and Isotachopheresis*, B. J. Radola and D. Grasselin, Eds., Walter de Gruyter, New York, 1977, pp. 165-171.
- [3] Righetti, P. G. and Gianazza, E., "pH Mobility Curves of Protein by Isoelectric Focusing Combined with Electrophoresis at Right Angles," in *Electrophoresis 79*, B. J. Radola, Ed., Walter de Gruyter, New York, 1980, pp. 23-38.

Suicide with Two Guns Fired Simultaneously

Sir:

Simultaneous firing of two guns as a mode of suicide was recently described in the *Journal* ("Suicide with Two Guns: A Unique Case," by A. Fatteh, S. B. Gore, G. T. Mann, and K. Garvin, Vol. 25, No. 4, Oct. 1980, pp. 883-885). The authors offered it as "a unique case," which it was to me, in addition to being instructive and interesting. One human characteristic is finding appeal in the esoteric; coincidence may also stimulate interest. Singularity and coincidence have me offering an "almost unique" case.

When the *Journal* reached the top of my reading stack one day in November, I read the report by my friend and former colleague. A few hours later, while browsing through an archival collection of reports from one of our counties' former coroners of North Carolina's days before medical examiners, I chanced upon a case similar to Dr. Fatteh's. It was dated 19 Jan. 1955. I'll quote the appropriate parts with minimal editing:

A, 47, a well known business man, committed suicide soon after one o'clock this morning in his office. He had telephoned his attorney, Mr. B, and talked with him for 25 minutes. He asked Attorney B a legal question about his will and some legal questions about his girl. He then asked Attny. B to come over and get him for he was fixing to get out of this world. Mr. A told B he had plenty of money but no health. (Mr. C says A was down in the dumps first of the week but finally got straightened out and was doing pretty well until this took place.)

A told Attny. B what he was going to do; B pled with him not to do such a thing. So A fired two shots and asked B if he heard that. He told him "yes."

Then A fired a pistol from each hand into each temple. The bullets went through his head and came out at the outside corner of each eye.

Attny. B immediately called the police and came to A's office. He and police found the door locked. After they broke in, A was found with two pistols, a 32 automatic in one hand and a 22 Colt automatic beside him. He left a note on his desk to his wife and daughter, "Sorry, but this is it."

He was taken to . . . Memorial Hospital and died in a few minutes.

"A clear case of suicide and no inquest will be held. It is thought ill health was the cause of the act."

The above case and the report by Fatteh et al appear to be not only remarkable instances of the use of two firearms in same act of suicide but also simultaneous firing of the two weapons. This situation is more than bizarre; it is a lesson in features of suicidal gunshot injury. One feature I desire to emphasize briefly is recognition that a significant number of multishot firearm deaths are suicides.

Little has been published about frequency, incidence, or other characteristics of multishot firearm suicides. Fatteh et al mention 13 among 844 consecutive gunshot suicides, an incidence of 1 in 65, from studies in North Carolina in 1970 and 1971 [1]. This is essentially identical to data from the same state in a later study (1972-1978), 58 among 3522 consecutive gunshot suicides, an incidence of 1 in 61 [2]. Greater awareness of this variety of gunshot death may reduce the anxieties of some death investigators and lessen the frequency or intensity of unwarranted homicide investigations.

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References

- [1] Fatteh, A. and Hayes, W. C., "Firearm Fatalities: Epidemiologic and Investigational Considerations," in *Legal Medicine Annual 1974*, C. H. Wecht, Ed., Appleton-Century-Crofts, New York, 1974.
- [2] Hudson, P., "Multishot Firearm Suicide: Examination of 58 Cases," *American Journal of Forensic Medicine*, Vol. 2, 1981, pp. 239-242.

Engineering Section of the American Academy of Forensic Sciences

Sir:

On 18 Feb. 1981, the formation of the Engineering Section was formalized by the American Academy of Forensic Sciences. Kenneth R. Feder was elected chairman, Charles Nagler was elected secretary, and I was elected fellow-at-large.

Members of other sections may transfer to the new Engineering Section by forwarding a written transfer request to the executive director of AAFS, together with an up-to-date curriculum vitae. New members must have a bachelor's or graduate degree from an accredited four-year college or a university ABET and must be currently and actively engaged in the application of forensic engineering science and must have been so engaged for a minimum of four years. A master's degree can be substituted for one year of activity, and a Ph.D. or doctor's degree can be substituted for two years of activity.

A number of AAFS members have been involved in the effort to develop the new Engineering Section since early 1975. I might mention particularly Prof. William Larsen, Dr. Raymond Mires, Pete Peterson, and Prof. Steve Batterman. Generally, there have been upwards of a dozen engineers who have spiritedly discussed and planned for the new Engineering Section.

The need for an Engineering Section has been apparent because there has been no group of professionals in the United States whose purpose is primarily to serve the forensic engineering community. Correspondingly, there is no unique forensic engineering curriculum, and those two lacks go together. Thus, forensic engineering applications have been occasionally mentioned in forensic science programs sponsored by various organizations. The Academy is a natural setting for a Forensic Engineering Section because such a Section must exist within the framework and in close operational coordination with the other disciplines that already characterize the Academy's activities.

As an example, the fundamental basis for many forensic investigations has to be an engineering investigation to develop the dynamics and kinematics of an occurrence or series of events. To define forensic engineering, one first has to define engineering. Engineering is basically involved in the practical application of the physical laws, which we all deal with in any case for the analysis, design, construction, operation, and maintenance of physical structures.

Engineers primarily are very applied people who work in a world of realizability and practicality. In the forensic arena they must apply their skills for the resolution of disputes in the litigative process. Engineers, with this very applied point of view, can bring new insights and applications to the ongoing engineering analyses in the forensic area. The Engineering Section will be composed of engineers who deal very substantively with engineering applications; one of our functions, in my view, will be a tutorial role, to see to it that the rest of the membership reflects in their own specialized work, the engineering framework within which crime scene and accident reconstruction must be accomplished. Forensic engineers are not mentioned extensively in the early case law. It is only in the last ten or fifteen years that engineers are mentioned to any extent in the case law. Their role in developing the framework within which events occurred, which were in dispute, and the importance of their

analyses, are noted frequently. There are many forensic engineers now engaged in this work, including among others, metallurgical, electrical, communications, automotive, mechanical, instrumentation, and chemical engineers.

Some of our Section's planned activities and programs include expansion of our membership base; defining the functions and range of activities of the new Section within the framework of the Academy; developing interactions with other engineering societies and other organizations outside of the AAFS framework; and establishing information, tutorial, and joint programs with the other Sections. In general, we will advance the professional status of the members of our Section and the theory and practice of forensic engineering. We will, in the longer run, attempt to develop forensic engineering curricula and training programs and perhaps a continuing education program not only in the framework of the annual meetings, but in other contexts as appropriate. We will look into a board certification basis for qualifying as a forensic engineer, to go beyond the professional engineering board or certification that is now provided on a state-by-state basis.

Importantly, engineers can bring a special, unique capability to the Academy that is derived from their knowledge of instrumentation. Engineers pay particular attention to methods of measurement and very frequently in their development work have to patch together new measurement techniques to meet new requirements. Eventually measurement systems are evolved and frequently result in new products. Thus, engineers have special qualifications for understanding the design and application of instruments and what is possible and feasible in terms of new developments, whereas many nonengineering forensic specialists have more of a utilization or user-orientation toward their test equipment.

The Engineering Section has already played a dynamic role in helping to formulate the Fire and Arson Program planned for next year's Annual Meeting in Orlando. I look forward to a continuing, highly productive contribution to the Academy's work.

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