

Forensic DNA typing dispute

SIR — Lander and Budowle¹, in declaring the end of the controversy over the forensic application of DNA technology, have presented a piece of propaganda that completely distorts the current situation in a very difficult matter at the nexus of science and law.

The errors of the article begin with its title. DNA patterns are not fingerprints, because unlike fingerprints, they are not idiotypes. The struggle to resolve the issues is not a “war”, in which all “weapons” are fair, but for some of us, at least, an attempt to find out what is true. Most important, the controversy is most certainly not laid to rest but in some ways has become more urgent because of technical changes in the methods.

There are three outstanding issues. First, there is a very serious problem of laboratory reliability of DNA technology. Lander and Budowle dismiss this problem, assuring us that laboratory practice is now being scrupulously overseen by, of all agencies, the Federal Bureau of Investigation (FBI). It is the FBI laboratory, from which Dr Budowle comes, that failed to replicate its own DNA profiles in 12 per cent of samples, in an internal test of its procedures², and which has consistently refused to allow independent third-party quality control of its work. It is ludicrous to set this fox to guard the henhouse.

The problem of laboratory reliability has been greatly exacerbated by the increasing use of PCR technology to amplify small samples. Typically, a large fresh sample of blood from the accused is worked on in the same laboratory or by the same technician as a minuscule scraping of blood or tissue from the crime scene. But, as everyone who uses the PCR technique knows, the probability of a false match by contamination of the minuscule crime scene sample, to be amplified, from the large sample taken from the accused, by mislabelling, aerosols, carelessly unchanged pipette tips and other similar laboratory sloppiness, is very great and many orders of magnitude greater than the tiny match probabilities calculated for forensic purposes. Moreover, the polymerase chain reaction technology is incapable of detecting new alleles that may be possessed by the suspect or present in the crime scene sample, but which have not yet been included in the test array. In the absence of blind proficiency testing, quality-control protocols and unannounced periodic checks designed and supervised by disinterested parties, the test results from federal, state and local crime laboratories, and private contract laboratories must be regarded as unreliable.

The second problem, that of correctly calculating probabilities when there is population heterogeneity, is dealt with by

Hartl in the accompanying letter.

Finally, because DNA profiles are not idiotypes, juries are asked to consider a numerical probability of matching. But there is an extensive literature about the ability of lay people to understand probability statements and to make decisions that accord with the logic of such statements (see, for example, ref. 3). The clear result of these investigations is that people not trained in quantitative methods cannot understand issues of statistical independence and the basic logic of probability statements. For example, it is common for people to believe that a 1 in 4 chance means that the event is bound to happen on the fourth trial. Nor can a one-time instruction by a judge be sufficient to correct these misunderstandings. Because juries are no more capable of interpreting probability statements than they are of interpreting any other piece of highly technical information, there are insuperable barriers to their use in the courts.

Given the DNA polymorphism in humans, it is within our reach to design sequencing methods that provide idiotypes, uniquely identifying individuals as real fingerprints do. Coupled with quality-control checks and proficiency testing by disinterested monitors, a system of forensic identification could be created that would on the one hand protect the innocent and, on the other, help to convict the guilty. So why does the FBI not devote its time and energy to such developments, instead of trying to defend and shore up a basically flawed system? Why did Lander and Budowle choose to embrace in the pages of a leading journal of science, just before Budowle is scheduled to appear before tens of millions on television as a witness for the prosecution in what is surely the most publicized crime since the assassination of John Kennedy? As the French say, it gives one to think.

R. C. Lewontin

*Museum of Comparative Zoology,
Harvard University, Cambridge,
Massachusetts 02138, USA*

SIR — It is welcome news that the FBI, in an astonishing 180° change of direction, has agreed to adopt the interim ceiling principle recommended by the National

Research Council (NRC)¹.

The reversal of policy is long overdue in view of the acceptance of the approach by many other DNA-typing agencies. The ‘interim’ ceiling principle, based on racial databases, is a stop-gap measure intended to be replaced by a more refined method based on databases from diverse ethnic groups. Alas, Lander and Budowle’s announcement ending the DNA ‘war’ contains no indication that the FBI intends to implement the refined form of the ceiling principle. Furthermore, numerous not-so-subtle hints suggest that even the interim ceiling principle may soon be abandoned.

Ask yourself why an article about the adoption of the interim ceiling principle would attack the biological rationale for the method? The ceiling principle was designed to compensate for the genetic substructure that exists in human populations. But Lander and Budowle assert that the evidence for substructure in the Lewontin–Hartl paper⁴ is “flawed” (see ref. 5), and that the FBI’s population surveys have found only “modest” differences among ethnic groups. How do these statements square with Budowle’s previous admission⁶ that it is “universally accepted that substructure exists within major population groups”? Indeed, statistically significant differences among ethnic groups have been documented for markers used in DNA typing (see, for example, ref. 7), including many comparisons among ethnic groups in the FBI’s own population surveys.

Statistical significance is an objective, unambiguous, universally accepted standard of scientific proof. When differences in allele frequencies among ethnic groups are statistically significant, it means that they are real — the hypothesis that genetic differences among ethnic groups are negligible cannot be supported. On what basis, then, does Budowle ignore substructure? Because the differences between ethnic groups are not “forensically significant” (p. 533 of ref. 6). When does a statistically significant difference become “forensically significant”? Well, “when the likelihood of occurrences of the DNA profile would be meaningfully different”⁸. And guess who decides whether differences are “meaningfully different” . . . ?

A short life for the ceiling principle is also intimated by the statement that the controversy over population substructure would have been disposed of several years ago had the FBI been given authority to set up a committee to rule on the issue. It would have “made short work of the population genetics issue, by clarifying, changing or discarding the original NRC recommendations” (ref. 1). In fact, the FBI has been granted such authority in the DNA Identification Act of 1994. Will “short work” be made of the interim ceiling principle?

1. Lander, E. & Budowle, B. *Nature* **371**, 735–738 (1994).

2. US vs Yee, 12 F.3d 540 (6th Circuit), 1993.

3. Palmerini, M. *The Illusion of Knowing* (Wiley, Chichester, 1993).

4. Lewontin, R. C. & Hartl, D. L. *Science* **254**, 1745–1750 (1991).

5. Hartl, D. L. & Lewontin, R. C. *Science* **260**, 473–474 (1993).

6. Budowle, B., Monson, K. & Giusti, A. M. *Am. J. hum. Genet.* **55**, 533–539.

7. Krane, D. E. et al. *Proc. natn. Acad. Sci. U.S.A.* **89**, 10583–10587 (1992).

8. Budowle, B. & Monson, K. in *DNA Fingerprinting: The State of the Science* (eds Pena, S. D. et al.) 171–191 (Birkhauser, Basel, 1993).

There are still other indications that are troubling. Why else insist that the FBI's product-rule calculation yields the "best estimate" instead of calling it what it is — an estimate more nearly at the nonconservative end of the spectrum that can be used in conjunction with the ceiling principle to bracket the true value? Why else attempt repeatedly to marginalize the issue of population substructure by labeling it as "purely academic"? Why else brush aside many other important issues, such as proficiency testing, accessibility of databases, and technical considerations relating to polymarkers and use of the polymerase chain reaction?

Daniel L. Hartl

*Department of Organismic
and Evolutionary Biology,
Harvard University,
Cambridge, Massachusetts 02178, USA*

Fighting fire with fire

SIR — Colin Macilwain¹ recorded the following memorable remark of a US politician: "we pay agencies to fight fires, not light them". In Western Australia, forest managers² have for three decades been using prescribed fires to minimize the possibility of destructive forest fires similar to those that recently affected the western United States.

The bushfire hazard in the southwest of Western Australia is arguably potentially more severe than in any other region of the world. This is because of its unique tall forests, which shed tonnes of highly flammable material each year, and a Mediterranean climate, that is, a climate that produces each year a 3–6 month drought with periods of high temperature and low humidity.

Fire is a naturally occurring element of southwest ecosystems, as natural as rain and sunlight. To the vegetation and native animals, it is simply a powerful disturbance factor from which, in time, the natural systems recover, or in the presence of which they evolve. Fire can also be an agent of death and destruction to human assets and values, and large wild fires are extremely costly.

In the southwest forests alone there have been more than 200 lightning-caused fires since 1988, any of which, without the benefit of prior planning burning, might have erupted into wildfires of the scale that devastated forests in Idaho. Fuel (fallen leaves, twigs, bark and sticks) is the only factor that can be managed, and this is Western Australia's first method of defeating wildfire. The other is a fast response by well-trained firefighters. The first method, reducing the fire's energy source, makes the second effective.

Prescribed, low-to-moderate intensity fires are not ecologically harmful³ — such fires were lit every year by aboriginal

Western Australians until shortly after settlement by Europeans in 1829. Indeed, millennia of frequent firing of Western Australian forests by aborigines resulted in one of the most productive and valuable hardwood forests in the world.

Syd Shea

*Department of Conservation
and Land Management,
Australia II Drive, Crawley, 6009,
Western Australia*

1. *Nature* **370**, 585 (1994).
2. Shea, S. R. *et al.* in *Fire and the Australian Biota* (eds Gill, A. M., Groves, R. H. & Noble, I. R.) 443–470 (Aust. Academy of Science, 1981).
3. Christensen, P. & Abbott, I. *Aust. For.* **52**, 103–121 (1989).

Russian bomb

SIR — I wish to clarify your report (*Nature* **370**, 85; 1994) about the open letter by ten Russian scientists, of whom I was one.

Your report says that those responsible for building the atomic bomb in the Soviet Union were motivated by the fear that, if they failed, they would be dismissed as idealists and suffer the same fate as biologists had done under Josef Stalin. The more explicit text of our letter says that "under the conditions that existed during the totalitarian regime of Stalin, a failure of the first test of the Soviet atomic bomb would certainly have led to harsh punishment of all of Kurchatov's team and to the total devastation of Soviet physics (as happened shortly before in 1948 to Soviet biology)". We went on to say that the devastation would have begun with the prohibition of relativity theory and quantum mechanics on the grounds that they were the "poisoned tools of ideological saboteurs" and the atomic test in August 1949 "in fact saved Soviet physics".

Moreover, the main spirit of our letter was dictated not by history but by the present situation in our country: we consider Sudoplatov's book and its wide coverage as typical examples of activities of "reactionary, antidemocratic, anti-intellectual forces" that use the attacks on science "not only to discredit our intelligentsia but also to create political tensions internally and internationally, to produce an atmosphere of xenophobia and to generate hostility and mistrust within the world scientific community".

Vitaly Goldansky

*Institute of Chemical Physics RAS,
4 ul. Kosygina,
Moscow 117977, Russia*

News and reality

SIR — Your leading article "How to deal with dreadfulness" (*Nature* **370**, 313–314; 1994) suggests that what concerns you is what appears "dreadful" to those who follow the news media, rather than the

experience of those of us who live every day with the events that interest the reporters. You mention the "wishes of the television-watching world" as if they interest you more than the wishes of those of us who live the events.

I have lived through many of these events for 14 years and notice a great disparity between the world in which I live and the world that is reported. The small subset of the actual events that is reported is selected by the reporters and by those skilful at guiding them. There are many distortions. Photographs get miscaptioned. Lenses can make a rifleman look as if he is aiming at someone at whom he is not aiming. Interviews, including voice recordings, are edited selectively. And even if one is quoted directly, one's success or failure at conveying one's experiences accurately is limited by one's ability to choose words quickly and appropriately, and by the ability of the audience to imagine a world they have never experienced. An expert at communications will sway the "television-watching world" better than a simple honest person who does not know how to express himself.

Governments, and the United Nations, make decisions aimed at pleasing the television watchers, and based largely on the data that appear in the news media. (Reports from "observers" may be discounted. When I soldiered in Lebanon I noticed that the United Nations (UN) troops never dared leave their base. And UN observers in Hebron see what they are shown.)

So I oppose your conclusion that the UN ought to intervene in the affairs of member states, undermining "to some degree" their sovereignty. Rather than intervening militarily in far-off events about which we can know little with any degree of scientific accuracy, we should each of us try to solve problems closer to home.

Frank J. Leavitt

*Kiriya Arba 303/2,
Hebron, Israel*

Help wanted

SIR — The Committee on Medical Aspects of Food Policy of the Department of Health has set up a working group to prepare guidelines on the nutritional assessment of infant formulas. The group will be chaired by Dr Peter Aggett, head of nutrition, diet and health at the Institute of Food Research in Norwich. The working group invites concise written submissions based on reasoned argument and scientific data from interested parties. Submissions should be sent to me.

P. Clarke

*Department of Health,
Room 593D Skipton House,
80 London Road, London SE1 6LW, UK*