

Detection of Plastic Explosives

M. Mitchell Waldrop, in his News & Comment article "FAA fights back on plastic explosives" (13 Jan., p. 165), describes the Federal Aviation Administration's new thermal neutron activation detector for plastic explosives in airline passengers' baggage. He says initial testing demonstrated "more than 95% detection probability, with less than 5% false alarms."

If one makes the very generous assumptions that there may be 100 bombs among the 10 billion bags that pass through U.S. airports annually, then there will be about 500 million false alarms each year. One wonders whether the FAA has plans in place to deal with the accompanying loss of vigilance the human operators of these detectors are bound to experience when they learn that the detectors signal the existence of 5 million or more bombs for each bomb discovered.

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Genes and Tongues

We would like to comment on Roger Lewin's Research News article (28 Oct. 1988, p. 514) about a paper by Luigi Luca Cavalli-Sforza *et al.* (1). The paper examines human history with genetic, archeological, and linguistic data and has attracted other reviews in the scientific press (2, 3)—apparently with minimal scrutiny by systematists and linguists. Its main conclusion, that there is "considerable parallelism between genetic and linguistic evolution" (1, p. 6002), is not adequately supported empirically and methodologically (4).

1) The tree of relationships among 42 "aboriginal" human races, constructed from 120 allele frequencies, is a phenogram for which Cavalli-Sforza *et al.* concede important statistical tests are not reported. The data-matrix contains an unacceptable number of missing values. A phenogram is an ahistorical clustering diagram of overall similarity and cannot be used directly to infer historical relationships. Despite assumptions to the contrary (1, 3), phenetic similarity is not necessarily indicative of kinship.

2) The races were delimited by arbitrary pooling within geographic regions. Examina-

tion of original data sources reveals many very small samples, sometimes of single individuals. Differences in the data preclude identification of the zones of positively correlated depressions in allele frequencies necessary to delimit races and assess intrarace variation.

3) The linguistic classification uses the 17 "families or phyla" recognized by Ruhlen (5). Poorly supported phyla such as Amerind, Na-Dene, Altaic, and Austric are given the same weight by Cavalli-Sforza *et al.* as well-supported families such as Indo-European and Dravidian.

4) The correspondence between the genetic and linguistic data is not particularly "remarkable." Cavalli-Sforza *et al.* state that "every linguistic phylum corresponds to only one of the six major genetic clusters defined by the [race] tree" (1, p. 6005), but subsequently note six exceptions. Elsewhere, appearance of correspondence is increased by delimiting six races on the basis of linguistic affinity (1, p. 6003). Potential problems, such as Munda, the form of Austroasiatic spoken in India, are not considered. Seven of the linguistic phyla are each uniquely associated with a single race on the genetic-data tree and are thus in agreement with any tree. Five of the remaining nine phyla support the tree presented: they occur only in races grouped in a major genetic cluster. The remaining four phyla do not support the tree: they occur in races belonging to non-contiguous clusters. Thus, of the phyla amenable to a test of agreement at the level of the major genetic clusters, the fit is only 56% (5/9).

5) Only Greenberg's (6) controversial Amerind phylum (7) corresponds with the grouping of individual races within a major cluster. Thus, of the nine testable linguistic phyla, only one (11%) does not conflict with the genetic-data tree in some way.

6) Neither of the linguistic "superphyla," Nostratic and Eurasiatic, precisely corresponds with the genetic-data tree. Cavalli-Sforza *et al.* state that Nostratic "includes six phyla that all belong to the Northeurasian major cluster" (1, p. 6005). However, their figure 1 associates one Nostratic phylum with a non-Northeurasian race and seven non-Nostratic phyla with seven Northeurasian races. The proposed addition of Amerind to Nostratic unites two groups erected by mutually exclusive techniques.

7) If, as the authors intended, the genetic-data tree is treated as a phylogeny, we can map the linguistic data onto the tree and measure the goodness of fit (8). This reveals that only 48% of the race-language associations support a conclusion of development and retention of a language within a racial lineage. The remaining 52% of the associa-

tions must be attributed to the independent origin of a language in more than one race, or to the replacement of one language by another.

8) We conclude by asking why one would expect correspondence between phylogenetic and linguistic relationships. Why should languages be expected to arise and persist in a lineage like physical traits? The history of language is known to have included extensive shifting and extinction without concomitant events in the races involved. Correspondence between linguistic phyla and genetic clusters does not necessarily indicate similar origins; it may arise from the independent parallel effects of geographical contiguity or separation. Any attempt to reconstruct global human history must deal with evidence that linguistic relationships reflect a much later period in human history than the genetic relationships among human populations. The wide reporting of the study by Cavalli-Sforza *et al.* does, however, show that it is possible to achieve a remarkable impact just by asking an important question.

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