

conserved G264 residue, this variation produces triplets that represent both sets of modern arginine codons, AGG and CGN.

All self-splicing group I RNA's so far examined have an arginine-binding site at this same location<sup>4</sup>. Sequence variations flanking the G residue that is apparently in contact with site-bound arginine produce three arginine codons and no others. The unbroken prevalence of this pattern in modern RNAs indicates that the sequences at this point must have also been arginine codons in ancient group I RNAs. This supports the suggestion<sup>4</sup> that this specific RNA-amino acid interaction may have

been a progenitor of the genetic code. The code, on this basis, probably developed from an ancient RNA codon-amino-acid interaction, as somewhat originally suggested by Woese<sup>5</sup>.

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## Homoeopathic test

SIR—The practice of homoeopathy depends on the use of medicaments prepared in a special way. Solutions derived from a variety of parent substances are progressively diluted, with a dilution factor of 1 in 100 at each stage. The resulting fluid is said to acquire a specific 'potency'. In clinical use it is essential that the medicament chosen shall be appropriate to the patient's condition; fundamental to this is the contention that the various potencies can be distinguished from one another. Some years ago, I put that contention to the following test.

In consultation with an eminent homoeopathic practitioner, a former

ment should be placed in each bottle. Each bottle was enclosed in a metal can and the whole batch was sent to the practitioner without revealing the key.

No constraints were placed on the practitioner's methods, whether chemical, physical, clinical, parapsychological, or even magical, for identification of the potencies, as the question at issue was whether any distinctions could be detected regardless of means. But the practitioner kept to the routine he used in clinical practice for matching remedies to ailments. In all, he carried out 19 complete and reputedly independent tests on the same set of 20 bottles between April 1958 and May 1967, and reported his final conclusions in March 1970.

be expected in 90, 70, or 60 per cent of trials respectively ( $p = 0.9, 0.7$  or  $0.6$ , respectively); 5, that the observed number of correct identifications could have been arrived at by some random procedure which carries no information about the nature of the items ( $p = 0.5$ ).

Table 1 sets out the means and standard deviations expected under each of these 5 hypotheses, for each of the 3 groupings of data, together with the actual values found. Table 2 sets out the conclusions from the various comparisons on the basis of Student's *t*-test at the 5% level.

The result for I ( $n = 19$ ) cannot be distinguished either from the distribution for  $p = 0.6$  or from that for  $p = 0.5$  (chance). The other comparisons lead to the rejection of all the hypotheses that involve some discriminative power, leaving only hypothesis 5, indicating that the results might just as well have been arrived at by chance alone.

For a truly blind trial, each bottle should have contained material with a variety of possible activities or no activity at all. The practitioner may have been influenced by the expectation that each bottle should show activity of one or other type, in equal numbers and with no blanks, thus making the task of identification easier. Despite this bias, the statistical tests do not support the claim that the two potencies can be distinguished, at least by the methods used by this particular practitioner. It is possible that such a distinction could be derived from their clinical use, but practitioners are understandably reluctant to carry out a double-blind clinical trial that involves giving a human patient the wrong medicament. Perhaps a veterinary practitioner might be less reluctant.

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TABLE 1 Hypothetical and measured distributions from homoeopathic tests

Calculated	I $n = 19$	II $n = 20$	III $n = 380$
1. $p = 1.0$	19.0	20.0	380
2. $p = 0.9$	17.13 ± 1.3	18.0 ± 1.34	342 ± 5.85
3. $p = 0.7$	13.3 ± 2.0	14.0 ± 2.05	266 ± 8.93
4. $p = 0.6$	11.4 ± 2.13	12.0 ± 2.19	228 ± 9.54
5. $p = 0.5$	9.5 ± 2.18	10.0 ± 2.24	190 ± 9.22
Measured	10.63 ± 2.14	10.1 ± 2.55	202

TABLE 2 Results of comparisons using Student's *t*-test

	I $n = 19$	II $n = 20$	III $n = 380$
1. $p = 1.0$	reject	reject	reject
2. $p = 0.9$	reject	reject	reject
3. $p = 0.7$	$t = 3.9$ (reject)	reject	reject
4. $p = 0.6$	$t = 1.09$	$t = 2.49$ (reject)	$t = 2.72$ (reject)
5. $p = 0.5$	$t = 1.59$	$t = 0.13$	$t = 1.3$

President of the Faculty of Homoeopathy, two specific potencies were selected for the test, namely, 'Natrium muriaticum 30C' and 'Sulphur 30C'. They are said to have strikingly different properties and to be strongly active. The practitioner declared himself quite confident that there could be no possibility of confusion between them.

A set of 20 uncontaminated bottles were numbered and then loaded with one or other of the medicaments, using a set of random numbers to decide which medica-

The results were analysed in three ways: I, the number of correct identifications per set of 20 different bottles examined in a single run; II, the number of times each bottle was correctly identified in the 19 attempts on the bottle; III, the total number of correct identifications overall.

These scores are compared with those expected on the following hypotheses: 1, that the potencies are identifiable with certainty (that is, probability  $p = 1$ ) as originally envisaged by the practitioner; 2, 3, and 4, that a correct identification could

## Amazon flooding

SIR—In his News and Views article on Amazonia during the ice-ages, P.A. Colinvaux referred to my hypothesis that the Amazon Basin was flooded to the 250-300-m contour by a great freshwater lake during the last glacial from about 45,000 BP (but not during previous glacials as might have been understood from the text). This lake, of course, was held in by a dam across the Amazon River, not by dams across its tributaries, which were also flooded, as Colinvaux stated. As well as draining north through the Orinoco, the lake would have drained south through the llanos of Bolivia to eventually reach into the South Atlantic.

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