Anticodons in the mammalian mitochondrial code[3-5]. Anticodon GAA pairs with codons UUU and UUC, anticodon UAA with codons UUA and UUG, anticodon UAG with CUU, CUC, CUA and CUG, and so on, except that CAU pairs with AUA and AUG

GAA	Phe	UGA	Ser	GUA	Tyr	GCA	Cys
UAA	Leu			—		UCA	Trp
UAG	Leu	UGG	Pro	GUG	His	UCG	Arg
				UUG	Gln		
GAU	Ile	UGU	Thr	GUU	Asn	GCU	Ser
CAU	Met			UUU	Lys	—	
UAC	Val	UGC	Ala	GUC	Asp	UCC	Gly
				UUC	Glu		

to the point where changes in the code would be so disruptive of key proteins as to be lethal[2]. Before this, organisms were small and primitive enough to endure such dislocations.

But the code froze only with respect to the number of amino acids in it. Duplication of tRNA genes continued and new anticodons appeared with higher codon-binding affinities, so that the fidelity of translation was improved. □

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New foods

Proving leaf protein's worth

from N.W. Pirie

THE second international conference on leaf protein* was held in Aurangabad in October 1982, some twelve years after the first had taken place in Coimbatore. In that interval, the potential of leaf protein has gained widespread recognition. The 92 papers submitted to the second conference came from 30 countries; scientists from 18 countries attended. As would be expected, most participants were from India: there is research on leaf protein, or a general interest in the subject, in 18 centres in that country.

Throughout the conference, small-scale production of leaf protein for local consumption was emphasized. An extraction unit was shown operating in a village near Aurangabad. Slides and a film of commercial leaf protein production for animal feed in France, New Zealand, Japan and US illustrated dramatically how little engineers know about the properties of leaf juice. Some equipment, originally designed for expressing oil from seeds, is used although it exerts unnecessarily intense pressure. To get protein-rich juice from pulped leaf it is inadvisable to use more than 2 or 3 kg cm^{-2} (the pressure exerted between finger and thumb). Anything more than that is wasteful and, because leaf fibre becomes tightly packed and impenetrable, detrimental.

The consensus was that heat coagulation is the safest way to separate leaf protein from the juice. Because of the amount of energy needed to heat the juice, coagulation by acidification or anaerobic fermentation was proposed. Such methods introduce the risk that recoverable protein will be lost by proteolysis, that pheophorbide (a photosensitizing agent) will be formed and that harmful bacteria will proliferate. While some participants advocated relatively crude and hazardous methods of coagulation, others suggested refinements aimed at making partly decolorized protein. It is difficult to see what need such products would satisfy. They would be very much more expensive than leaf protein made simply by coagulation and washing, the processes used would be beyond the capacity of small-scale producers and useful lipids would be lost. By judicious use of counter-current heating the energy needed for heat coagulation can be diminished and, if a diesel rather than an electric motor is used for pulping and pressing, heat would be an abundant by-product.

A few participants objected, for political and pseudo-ethical reasons, to the use of leaf protein as a human food, but the majority could see no force in these arguments. An immense range of leaf species is already eaten in different countries, though the amounts eaten are often less than is desirable. The processes of extraction, coagulation and separation will increase the potential range of species because most of the small molecules are removed, and leaf protein is exposed to no treatment that is not part of normal domestic cooking. Provided leaf species are chosen sensibly and processed skillfully, fears about possible toxicity are groundless.

Dried leaf protein has so far been used in all the feeding trials that have been published. The use of dried material is convenient, but drying is troublesome and diminishes the nutritive value of the protein. There was a useful paper on the preservation of moist leaf protein with three different cultures of lactobacillus, and a paper on the stability of β-carotene in moist leaf protein preserved with salt or acetic acid. The value of leaf protein as a food which supplies carotene (pro-vitamin A) in the finely divided lipid environment which facilities absorption, was also stressed.

Besides leaf protein, fodder fractionation produces leaf fibre, from which part of the protein has been extracted, and the soluble components in a 'whey' which runs away from the coagulum of leaf protein. The former is economically the most important of the three products. Several papers dealt with its use as a ruminant feed, and with its conservation by drying or ensiling. There has so far been little work on the use of the 'whey' — it is, as a rule, returned to the land as fertilizer. However, the growth of yeasts and the production of penicillin on it were described. □

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* Among Indian sources of finance for the conference were the University Grants Commission and the Indian National Science Academy. Assistance with travel grants came from the Commonwealth Foundation, the United Nations University and the Royal Society. R.N. Joshi and Narendra Singh made vigorous efforts to collect typescripts: publication of the proceedings of the conference is proposed.

Apology

We apologise to K.R. Kim and his collaborators H. Craig and Y. Horibe for publication of their graph of the methane anomalies above the Mariana Trough rift valley (*Call* Alvin *for hot science, News and Views* **215**, 214; 18 November 1982). The graph was circulated (and related results reported) at the 5th International Conference on Isotope Geology, Nikko but was not yet ready for general release. A full account of the work is currently in preparation.

Corrigendum

In the *News and Views* article 'Yet another opioid peptide' by Leslie L. Iversen (*Nature* **299**, 578; 1982), the statement that Corbett *et al.* (*Nature* **299**, 79; 1982) found dynorphin$_{1-8}$ to be "much more rapidly metabolized in brain than the full-length dynorphin" does not accurately describe what these authors reported. Their experiments with peptidase inhibitors suggested that this might be the case in the various peripheral tissue bioassay preparations used, but the idea that the same may hold true in brain was an inference which goes beyond presently available results. The correspondent apologizes for this innacuracy.

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