news and views

Single mutation with two effects in tRNA

SINCE suppression was first discovered by the isolation of mutations that allowed some transfer RNAs to respond to nonsense codons instead of to their usual nucleotide triplets, the effects which mutational alteration may have upon tRNA have proved to be one of the most useful probes for investigating its function. The classical suppression of ochre (UAA) and amber (UAG) nonsense codons proved to be due to substitutions in the anticodons of tRNAs for glutamine, leucine or tyrosine, all possessing codons related to the nonsense triplets by a single base change. Missense suppression can result from a similar phenomenon, when a tRNA suffers a change in its anticodon which causes it to recognise a codon that usually represents some other amino acid. Another form of suppression involves frameshift mutations, in which a mutant tRNA restores the correct reading frame of the message, apparently acting at the codons GGG or CCC; whereas tRNA for glycine, for example, usually recognises GGG, a mutant seems able to respond to GGGG.

All these mutations are dominant; the presence of mutant tRNA achieves suppression. But what happens in the haploid bacterium at codons to which the mutant tRNAs would formerly have responded? When dominant suppressors can be isolated, presumably more than one tRNA must recognise their wild type codons, so that the capacity to translate these triplets remains even after mutation of one of the tRNAs. This explains why only some of the amino acids possessing codons related by single changes to the nonsense triplets can generate suppressors—presumably the others are recognised by only a single, essential tRNA whose mutation is lethal.

But the objection to mutation in essential tRNAs is overcome if the cell is made diploid for these genes; as Soll and Berg (*Proc. natn. Acad. Sci. U.S.A.*, **63,** 392; 1969; *Nature,* **223,** 1340; 1969) showed, in this case further suppressors can be isolated and they are recessive-lethals—if the bacterium is returned to a haploid condition, the suppressor tRNA is lethal, because there is no tRNA able to respond to its former codons. One of the two recessive-lethal suppressors that they isolated, $su7^{+}$, has the surprising property of inserting glutamine at amber codons, surprising because dominant glutamine suppressors have previously been isolated and recessive-lethals were expected to implicate new amino acids in suppression. The unusual properties of the glutamine lethal-recessive suppressor are the subject of studies reported in the *Journal of Molecular Biology* by Soll (**86,** 233; 1974) and Yaniv, Folk, Berg and Soll (*ibid.*, 245).

Until very recently, all suppression—nonsense, missense or frameshift—mediated by tRNA seemed to be due to changes in the sequence of the anticodon that change the coding response of the transfer molecule. But Hirsh (*J. molec. Biol.*, **58,** 439; 1971) found that a UGA suppressor results from a mutation at position 24 of tryptophan tRNA, not located in the anticodon but allowing the molecule to respond to UGA as well as to its usual codon, UGG. And mutations affecting not the codons recognised by tRNA but instead the amino acid with which it is charged were recently isolated by Smith and Celis (*Nature new Biol.*, **243,** 66; 1973) and Celis *et al.* (*Nature new Biol.*, **244,** 261; 1973; see also *Nature,* **249,** 690; 1974). By examining the ability of cells possessing the $su3^{+}$ gene, which inserts tyrosine at amber codons, to suppress nonsense mutations at which tyrosine is not acceptable, they isolated mutants of $su3^{+}$ which continue to recognise the UAG amber codon, but insert glutamine instead of tyrosine. All five mutations constituted single base substitutions in the amino acid acceptor arm of the tRNA.

That the insertion of glutamine by the $su7^{+}$ suppressors results not from mutation of a glutamine tRNA but instead from a change in the charging specificity of another tRNA is the conclusion supported by the studies of Soll and Yaniv *et al.* Soll reports that the *su*7 locus in *Escherichia coli* is identical to a locus in *Salmonella typhimurium* at which Miller and Roth (*J. molec. Biol.*, **59,** 63; 1971) previously isolated recessive-lethal suppressors of UAG and UGA codons that seem to be allelic. By obtaining a φ80 phage carrying the $su7^{-}$ gene, Soll showed that the *E. coli* locus also can suffer single step mutations to yield $su7^{+}_{UAG}$ or $su7^{+}_{UGA}$ suppressors. That both suppressors result from mutation of a single tRNA gene carried on the phage is suggested by the subsequent conversions possible from the

Is Jupiter lord of the Solar System?

THE idea that Jupiter and the Sun might be considered more sensibly as a binary system than in the respective roles of humble planet and dominating star is not particularly new. But on page 35 of this issue of *Nature,* Drobyshevski takes the idea an intriguing step further; according to his calculations, the dominant partner in the early stage of the development of the binary was Jupiter, and not the Sun.

Jupiter is certainly more like a small starlike body which has insufficient mass to trigger nuclear burning than like the other planets of the Solar System. According to Drobyshevski, one can be more specific and identify Jupiter with the core of the protosun. The process by which the original primary in the evolving binary system has become very much the secondary will be familiar to students of stellar evolution. At one time, it was something of a puzzle that the lower mass components in many binary star systems are found to be more highly evolved than their more massive companions, since a more massive star should evolve more rapidly. But this has now been explained in terms of mass exchange between the components of binary systems.

That is essentially how Drobyshevski explains the evolution of the early Solar System, with details of the process also offering a reasonable explanation of the formation of the other planets. And as a final bonus, the slow rotation of the Sun also emerges from the calculations when the angular momentum of the material streaming between the original binary companions is considered.

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