100 years ago

A balloon ascent was made at Cherbourg, on the occasion of the *féte* given by the Municipality to M. Grévy, by MM. Perr and Capt. Gauthier. The general direction of the wind being from the land to the sea, a government steamer was sent out to secure the safety of the aëronants if necessary. Before starting not less than thirty pilot-balloons were sent up to ascertain the superposition of the aerial currents. It was proved that at 40 metres the wind was blowing from the sea. After having travelled for more than an hour in the direction of Portsmouth the aëronauts opened their valve and returned safely on shore. More than a hundred thousand spectators witnessed the experiment. The culminating point of the ascent was an altitude of 1,500 metres, where the travellers could see the English coast, the whole of the Isle of Wight, &c. The scenery is stated to have surpassed description. Some very curious observations were made on the colours of the sea. In the places where the water is very deep it looks quite inky, and the curves of level are so clearly manifested that they bear comparison with equidistance lines worked on ordnance maps. When travelling at so great an altitude ships can be detected with some difficulty; but smoke can be seen even when the smoke-producing steamer can hardly be perceived with the naked eye.

On the evening of July 20, about half-past eight o'clock a remarkable meteor, said to have resembled a comet, apparently about twenty yards in length was observed at Vizimgaum and other places in India, traversing the sky from south to north, and remaining visible for about three-quarters of a minute, during which time the whole sky and country were brilliantly illuminated. The meteor then burst, and some time afterwards a loud sound like distant thunder, which lasted two minutes, was heard.

At a concert given every night in the garden of the Palais Royale, Paris, the orchestra is placed in the vicinity of the fountains which are illuminated by eight splended Siemens lamps, which work admirably. Two other Siemens lamps have been placed in the shop of a jeweller in the Galleries, and the experiment may eventually lead to the lighting of the whole palace by the electric light.

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Maverick mitochondria

from a correspondent

LAST November, readers of these columns will recollect, the news broke that the genetic code, hitherto thought to be universal, was different in mitochondria. Now, new and startling revelations concerning the machinery that mitochondria use to translate the genetic code are described in three recent papers (*Proc. natn. Acad. Sci. U.S.A.* 77, 1980).

Mitochondria are organelles which exist inside eukaryotic cells where they perform the rites of oxidative phosphorylation. They possess their own DNA which contains genes for the enzymes they require for these rites as well as for their own ribosomal RNA and tRNA. To grasp the importance of the new findings we must first note that the 64 possible codons may be arranged in 16 families. Each family is defined by the first two bases of its codons so that, for instance, GU*N*, where *N* can be U,C,A or G defines the codons of the GU family. It is convenient to refer to the two codons of a family with a pyrimidine (U or C) in the third or 'wobble' position as the prymidine codons and the other two with A or G as the purine codons. In the standard genetic code, eight of the 16 families are unmixed: that is say all four codons in one family code for the same amino acid. In the mixed families several patterns of assignment exist; in six of them the pyrimidine codons signal one amino acid and the purine codons another or, in one family act as termination signals.

In the standard translational machinery, the codons interact one after another with tRNA molecules each bearing an appropriate amino acid. Each tRNA molecule has an anticodon of three bases that interact in an anti-parallel manner with the codon forming three base pairs. The first two base pairings are of the standard Watson-Crick type but the third in the wobble position may be more variable. In this way an anticodon may read from one to three different codons of the same family according to the nature of the base in its wobble position. For instance,an anticodon with U in the wobble position may read both purine codons of a family and one with G may read both pyrimidine codons. With the rules of wobble pairing in mind, it can be shown that a minimum of 31 types of tRNA are required to read the standard genetic code.

The three new papers first of all extend and consolidate our knowledge of the deviations from the standard code that occur in mitochondria from *Neurospera crassa*. (Heckman *et al. Proc. natn. Acad. Sci. U.S.A.* **77**, 3159; 1980), from mammals (Barrell *et al. Proc. natn. Acad. Sci. U.S.A.* **77**, 3164; 1980) and from yeast (Bonitz *et al. Proc. natn. Acad. Sci. U.S.A.* **77**, 3167; 1980). In mitochondria from all three species it now transpires that UGA, instead of acting as a termination signal, codes for tryptophan as does the other purine codon from the UG family. In the AU family the code differs from standard only in mammalian mitochondria where the pyrimidine codons signal isoleucine and the purine codons methionine. Yeast and *Neurospera* abide by the standard pattern in this family. A further change occurs in the unmixed CU family of yeast in which all four codons signal threonine instead of the standard leucine. Apart from these deviations, the other codon assignments in mammals and yeast appear to be standard except for a suggestion that certain codons, normally used for arginine and which have not been detected in portions of the genome translated into protein, may be used as termination signals. In *Neorospera* no further deviants have been detected but the data are still incomplete. It may be noted in summary that the codes used by these three species not only differ from the standard but also differ among themselves. How many other deviations will show up in mitochondria from other species remains to be seen.

These observations, interesting though they may be, do not constitute the major bombshell delivered by these papers. As portents have been seen for some time it is disturbing that nobody has been able to find a full complement of 31 tRNA species in mitochondria, particularly since it has been shown that no extra tRNA is imported from the cytoplasm, at any rate in mammals.

Barrell *et al.* have now shown, by sequencing virtually the entire mitochondrial genome, that there are indeed only 23 tRNA genes in HeLa cell mitochondria. Similarly Bonitz *et al.* have found only 24 in yeast. An examination of the putative anticodons of these genes allows each to be assigned to a codon family. When this is done it is seen that eight are assigned to unmixed families. Invariably in mammals and in 7 cases in yeast these anticodons have a putative U in the wobble position. Since most of the 32 codons involved appear to be used to code for the

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