the determination by two-dimensional NMR spectroscopy of the structure of a ribozyme derived from self-cleaving plant viroid RNA; this ribozyme is in the 'hammerhead' class, so-called because of the secondary structure the RNA is predicted to adopt based on a pattern of conserved sequences. Although the NMR data Pardi's group have obtained so far are insufficient for full structure determination, they have already revealed the presence of a stable hairpin-loop.

Much of the interest in the catalytic potential of RNA stems from the wish to test the feasibility of an 'RNA world' early in evolution, in which self-replicating RNA systems existed in the absence of proteins. With the advent of proteins and the genetic code, it is supposed that RNAs retreated from the central functional role in cells, being left with activities such as pre-mRNA splicing and translation which involve dealing with other RNA molecules and to which they are therefore particularly suited.

The observations reported by A. Lambowitz (Ohio State University) provide what may be a glimpse of an interaction between RNA and protein that may have evolved relatively recently. A few years ago Lambowitz's group discovered that the removal by splicing of introns of the group I class from precursor RNAs in *Neurospora* mitochondria depends on a nuclear gene; it turned out that the gene encodes the enzyme mitochondrial tyrosyl transfer RNA synthetase. They have now found that this enzyme binds directly to the 'core' region of introns, containing the conserved sequences that define the group I class of introns, and that it does so by the same binding site by which it binds to tRNA.

Interestingly, the sequences of the intron to which tyrosyl tRNA binds can in principle be folded in the pattern predicted for group I introns from phylogenetic and mutagenesis studies. At the same time, they exhibit some of the characteristics of tyrosine tRNA. At some stage in its past history, random changes to the intron sequence presumably created a variant that sufficiently resembles tyrosine tRNA for it to bind tyrosyl tRNA synthetase, and for some reason this interaction proved beneficial. In the course of subsequent evolution, the intron may have come to depend on this interaction with tyrosyl tRNA synthetase for splicing.

With the intense interest in the potential activities of RNA both for the insights they may give into early events in evolution and the possible benefits of exploiting catalytic RNAs, it seems that the prediction made by Olke Uhlenbeck (University of Colorado, Boulder) that the 1990s will be the 'decade of RNA' may not be wide of the mark. □

Geoffrey North is an assistant editor of Nature.

SOLAR CYCLE

The Sun's disturbing behaviour

Kenneth H. Schatten

THE "unique series of solar cosmic-ray events" reported by Mathews and Venkatesan on page 600 of this issue[1] is one of several indications that, underlying the usual solar cycle (with a period of about 11 years), levels of solar activity have been increasing gradually over the past 400 years. As the Sun has engaged routinely in such increases and decreases in activity (varying on timescales of a few hundred years) for at least the past few thousand million years, this observation is scarcely a cause for alarm. But it does mean that we should expect the complex atmospheric effects that accompany such increased activity.

Increases in solar activity are manifest in a wide range of effects, including greater numbers of sunspots and solar flares, variations in the solar constant (the amount of solar energy incident on the Earth), greater fluxes of solar ultraviolet and extreme ultraviolet radiation, solar X-rays and protons, and geomagnetic storms in the Earth's atmosphere. We can survive these effects readily, being protected by both the atmosphere and the Earth's magnetic field. Some of our more recent and sensitive creations, however (such as satellites, radio communications and electrical power systems), can suffer from these anomalies.

In particular, these consequences of solar activity can create, in turn, the following terrestrial effects: fade-out of over-the-horizon radio communication

The solution for teething troubles

IT is a commonplace in anthropology that the present can provide a key to understanding the past. Writing in the *American Journal of Physical Anthropology*, Brown and Molnar[1] demonstrate the effectiveness of the approach by answering a question that has puzzled those in the field for well over half a century[2]. The question is to do with marks left by some unknown cultural practice that seems to have endured in our hominid ancestors for more than two million years[3].

The physical traces of the practice are clear, usually consisting of grooves on interproximal tooth surfaces, at or near the cemento-enamel junction, principally in the molar and premolar regions, and occurring more commonly in males than females. The grooves are horizontal, forming semicircular channels on both of two apposed teeth, with the combined channel ranging in diameter from 1 to 4 mm.

As Paul Bahn[4] explained in his News and Views article on the topic last year, several proposals have been put forward to account for these observations — root caries (dental erosion, in which bacteria have attacked the tooth surface); gritty saliva having been propelled through the teeth; and fibre processing resulting from the stripping of highly abrasive grasses and leaves. Perhaps the most common suggestion has been that the grooves were caused by use of a probe of bone or wood — a toothpick of sorts — to palliate dental problems such as gingival irritation. But all of these hypotheses remained at the level of conjecture in the absence of systematic observations on living humans still following practices that might have produced the grooves.

Brown and Molnar have now made such observations — to my mind the answer is in, and it is simple and satisfying. Analysing both the dentition of aboriginal skulls from South Australia and cinematographic records of aboriginal society[5], they show that the lesions result from the stripping of animal sinews. The preparation and use of animal sinews has been recorded on two films, *The Woomera* and *Aboriginal Spears*. Each shows the stripping of kangaroo sinew through clenched posterior teeth, producing a thin but strong cord for fixing a carved wooden peg to a woomera (spear-thrower) or a carved wooden tip to a spear shaft. Thinned and pliable sinews, like dental floss, slip between the contact points of adjacent teeth and reach the cemento-enamel junction. Continual stripping in the same region produces abrasion at the junction and, in due course, interproximal grooving.

Because such lesions are very similar in all populations in which they have been reported, it is reasonable to infer that they have a common cause and it would be difficult to find one more fitting than that identified by Brown and Molnar. Palaeoanthropology is replete with unsolved problems — it is good to see even one removed from the roster.

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1. Brown, T. & Molnar, S. *Am. J. phys. Anth.* **81**, 545–553 (1990).
2. Siffre, A. *Bull. Soc. Prehist. fr.* **8**, 741–743 (1911).
3. Boaz, N.T. & Howell, F.C. *Am. J. phys. Anth.* **46**, 93–108 (1977).
4. Bahn, P.G. *Nature* **337**, 693 (1989).
5. Richardson, N. *Australian Aboriginal Studies* **88**, 56–58 (1988).