

constructed or spontaneously assembled from mixed polymer systems consisting of DNA, RNA, peptides and perhaps other polymers and their building blocks? Can such systems evolve to 'neighbouring' autocatalytic systems while retaining 'catalytic closure', and could current life have evolved from one?

The new autocatalytic ligation-reaction system is merely exergonic: left to its own devices, the system will simply run to equilibrium. Can an autocatalytic system be created that carries out thermodynamic work cycles whereby the system sustains displacement from equilibrium, performs coordinated work and achieves such coordination by controlling, constraining and 'correcting' unwanted side reactions (as in DNA editing and repair; P. W. Anderson, personal communication, and ref. 4) to enhance its own rate of reproduction?

The dominant view of life assumes that self-replication must be based on something akin to Watson-Crick base pairing. The 'RNA world' model of the origins of life conforms to this view. But years of careful effort to find an enzyme-free polynucleotide system able to undergo replication cycles by sequentially and correctly adding the proper nucleotide to the newly synthesized strand have not yet succeeded^{5,6}.

A polynucleotide system based on a ribozyme polymerase able sequentially to add the correct nucleotides (and thus copy itself) might work. In contrast, the simple and successful reproducing molecular systems described by Lee *et al.*¹ and by von Kiedrowski² which uses a single-stranded DNA hexamer and its two trimer fragments) are based on a polymer catalysing its own formation from two fragments. Both show that autocatalytic systems based on specific ligation reactions are possible. Because a variety of polymers and small molecules can catalyse such reactions, these results may prove seminal: the creation or spontaneous formation of simple or collectively autocatalytic sets may occur far more readily than we thought. Given the emerging field of 'molecular diversity', with its capacity to synthesize high-diversity DNA, RNA and peptide libraries⁷, these questions are now open to detailed scrutiny. □

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Attention is everywhere

Kenneth H. Britten

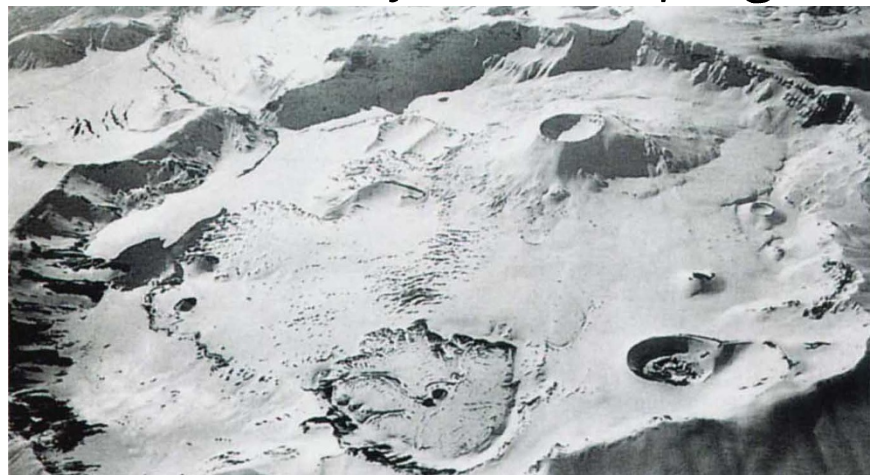
VISUAL attention is one mechanism that enables us to emphasize important objects or spatial locations over less important ones. This process has been the target of extensive scrutiny owing to its strong appeal as an example of 'higher' cognitive processing that is fairly straightforward to define, manipulate and measure. But despite the intensity of our attention, our understanding of its physiology remains patchy. Until now, for example, we have known next to nothing about the effects of attention on the pathway to the parietal lobe, even though this appears to be one of the key loci controlling spatial attention¹.

This lacuna is now well on the way to being filled by the work of Treue and Maunsell, which appears on page 539 of this issue². In a simple and elegant experiment using alert monkeys, they carefully

measure the effects of directed attention in two structures on the pathway that leads to the parietal lobe. By recording from motion-sensitive neurons while the monkey attends to one of two or three simultaneously moving dots, these authors discovered that impressive modulatory processes are in operation which are as large as any seen elsewhere in the visual system. In their experiments, the attended stimulus takes greater control of cells' responses than does the unattended stimulus; they are about equal in the absence of directed attention. Such an effect has been seen previously in other visual areas, and raises the simplifying prospect that one process or set of mechanisms supports selective attention throughout the visual system.

The primate visual system is organized into two largely separate pathways, ▶

An unhealthy volcanic spring



THE destructive armoury of volcanoes includes landslides, rivers of lava and glowing clouds of pumice, ash and hot gas. Floods of water make a strange addition to these, but a paper published last month (C. F. Waythomas *et al.* *Geol. Soc. Am. Bull.* **108**, 861-871; 1996) describes how, some time between 3,400 and 500 years ago, a volcanic crater lake in Alaska burst through its rock walls and emptied its billions of tonnes of water onto the plain below.

The Aniakchak River now flows from that lake's remnant, the well-named Surprise Lake (on the left in the 10-km caldera pictured above), and out of the v-shaped notch in the caldera rim called The Gates. That notch, and the wave-cut terraces inside the caldera showing how large the lake once was, helped lead R. G. McGimsey *et al.*

(*USGS Bull.* **207**, 59-71; 1994) to first postulate a catastrophic flood.

Waythomas *et al.* now show how rapidly it must have happened. To carry the biggest of the boulders found downstream, more than 20 m across, the flow rate must have been more than 100,000 m³ s⁻¹. Analysis of downstream erosion and a dam-break model broadly agree.

Was this a freak event? Other empty calderas around the world have similar rim notches and fan-shaped patterns of deposition downstream. If they too have produced catastrophic floods, then many crater lakes, such as the huge, 40-km³ Atitlán in Guatemala, may be able to do the same. And at Ruapehu volcano in New Zealand, near a small notch through which a lake drains, the caldera rim is moving outwards by 10-15 mm yr⁻¹ as the glacier that supports it retreats. S.B.