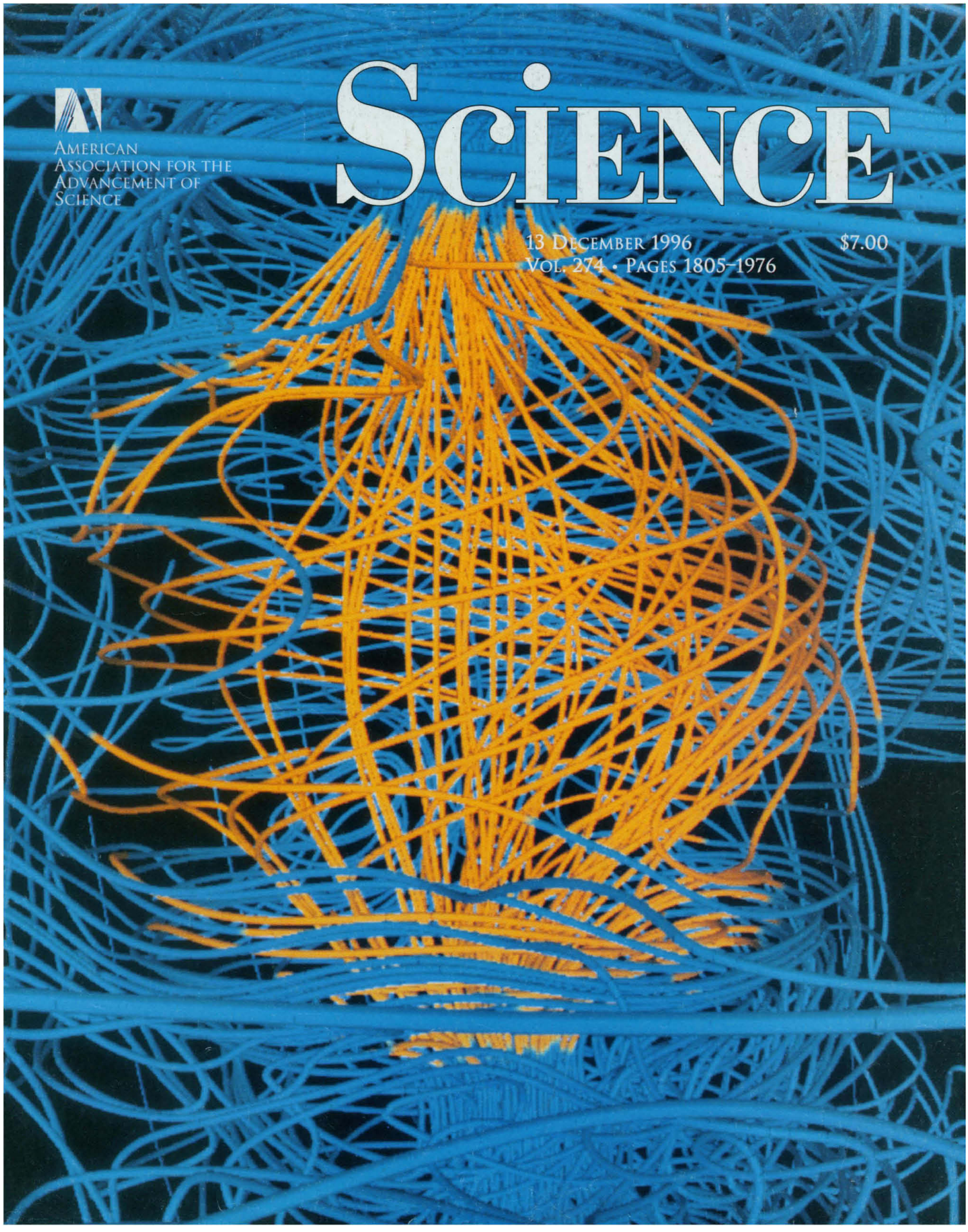

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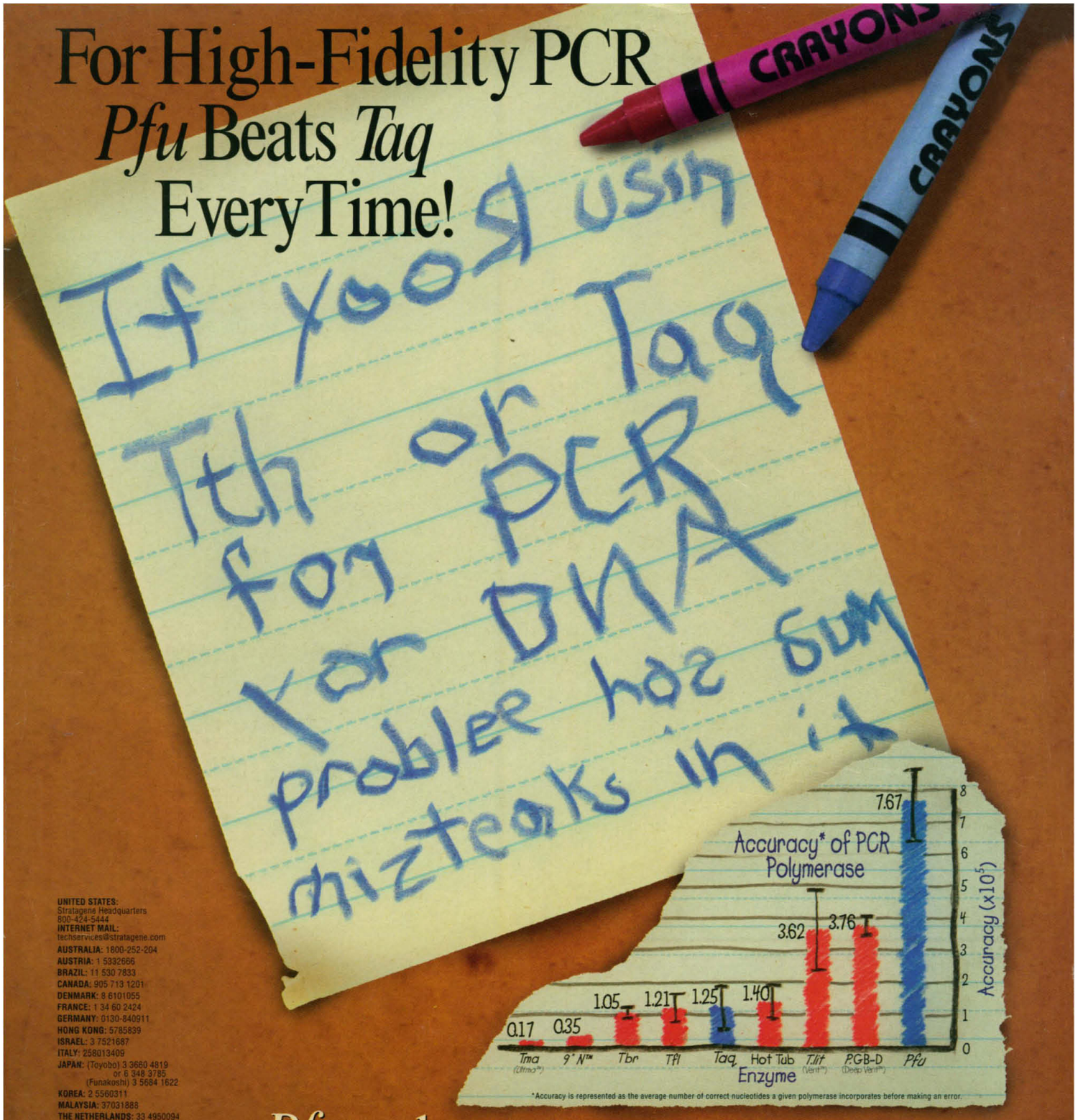

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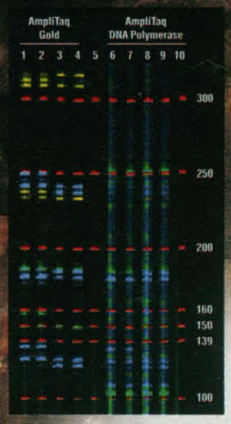

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1997 Award Announcement

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Grants announced:	June 30th, 1997
Fellowships start:	October 1997

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COVER

Snapshot of the magnetic field inside Earth's core simulated by a geodynamo model. Magnetic lines of force are gold where they are inside, or blue where they are outside, the solid inner core. The Earth's axis of rotation is vertical in this image. The field is directed inward at the inner core north pole (top) and outward at the south pole (bottom). The maximum magnetic intensity is about 30 millitesla. See page 1887 and a related report on page 1883. [Image: G. A. Glatzmaier and P. H. Roberts]

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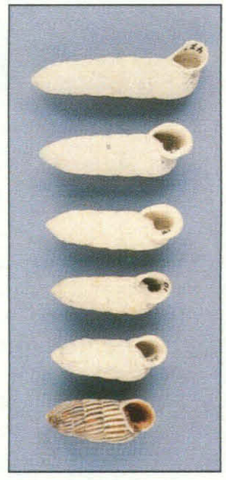

1842 & 1894
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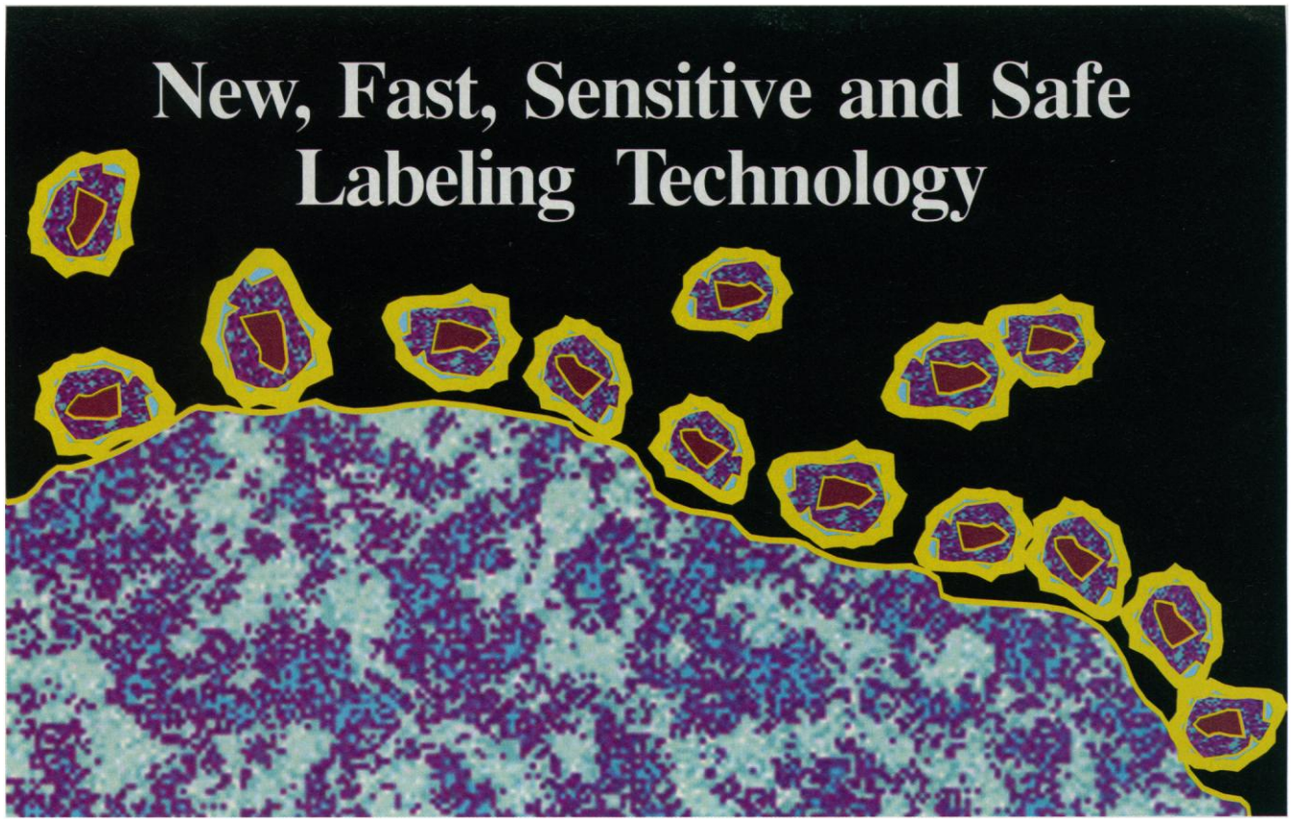

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edited by BROOKS HANSON

Heinrich events go south?

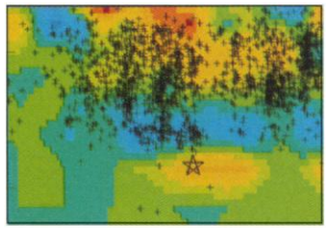
Heinrich events mark abrupt episodes of discharge of icebergs from the continental ice sheet covering North America during the last glaciation. The climatic causes of these events and whether they are local or hemispheric in scale are not clear. McIntyre and Molfino (p. 1867) show that peaks in abundance of a marine alga in a high-resolution climate record from the equatorial Atlantic Ocean spanning the last 45,000 years are coeval, within age-resolution, of the last several Heinrich events. They suggest that the cycles, which occurred about every 8400 years, are caused ultimately by variations in Earth's orbit.

Zipping around

It was recently shown by Song and Richards that the Earth's inner core is spinning faster than the mantle by about 1° per year. Su *et al.* (p. 1883), using independent observations of 29 years of seismic waves traveling through the core, suggest that the inner core is indeed rotating faster, perhaps by as much as 3° per year ahead of the mantle. Glatzmaier and Roberts (p. 1887; cover) simulated the geodynamo and find that the inner core's super-rotation may be explained by the coupling of the inner core's magnetic field with an eastward-moving thermal wind in the fluid outer core.

Slippery when wet

The cause of the magnitude 7.2 Kobe, Japan, earthquake in January 1995 is unknown. Zhao *et al.* (p. 1891) developed a tomographic model of the velocity structure of the crust beneath the epicenter and the extended aftershock zone. Their images show that the hypocenter of the earthquake was in



a distinctive zone, characterized by low *P*-wave and *S*-wave velocities and a high Poisson's ratio, suggestive of the presence of fluids that may have helped facilitate the earthquake.

Quickly ironed out

Following the Big Bang, debris accreted together in the inner solar system to form planetesimals. Lee and Halliday (p. 1876) measured ^{182}W isotopic anomalies in meteorites, which are produced by decay of ^{182}Hf (half-life of 9 million years), to date the accretion and segregation of iron cores (which prefer W relative to Hf) in some of these parent bodies. The tungsten isotopic anomalies of iron meteorites (perhaps representing cores) are similar to anomalies in metal grains in ordinary chondrites (silicate mantle and crust). This result suggests that the parent bodies and their cores formed at the same time and within a few million years of the origin of the solar system.

Wounded reaction

Plants respond to being wounded by increasing the production of proteinase-inhibitor genes, which in turn block the feeding of insects that caused the damage. O'Donnell *et al.* show (p. 1914) that the signals regulating expression of these genes include ethylene as well as jasmonates. Ethylene production is detectable shortly after wounding and well before changes in the transcription of the proteinase-inhibitor genes are detected.

Fits of forgetfulness

Adult zebra finches are capable of recognizing and remembering songs of other birds, and the duration of the memory varies with song type. Chew *et al.* (p. 1909; see Perspective by Doupe, p. 1851) monitored neuronal activity in the auditory centers of awake zebra finches while they were presented with various songs. An unexpected finding was that the birds appeared to forget the song only at six narrow windows with durations of 1 to 4 hours during 4 days of testing. These windows marked periods of gene expression and protein synthesis that were required to maintain the longer lasting memories. Thus, it appears that remembering these songs depends on quantized waves of macromolecular synthesis.

Extended damage

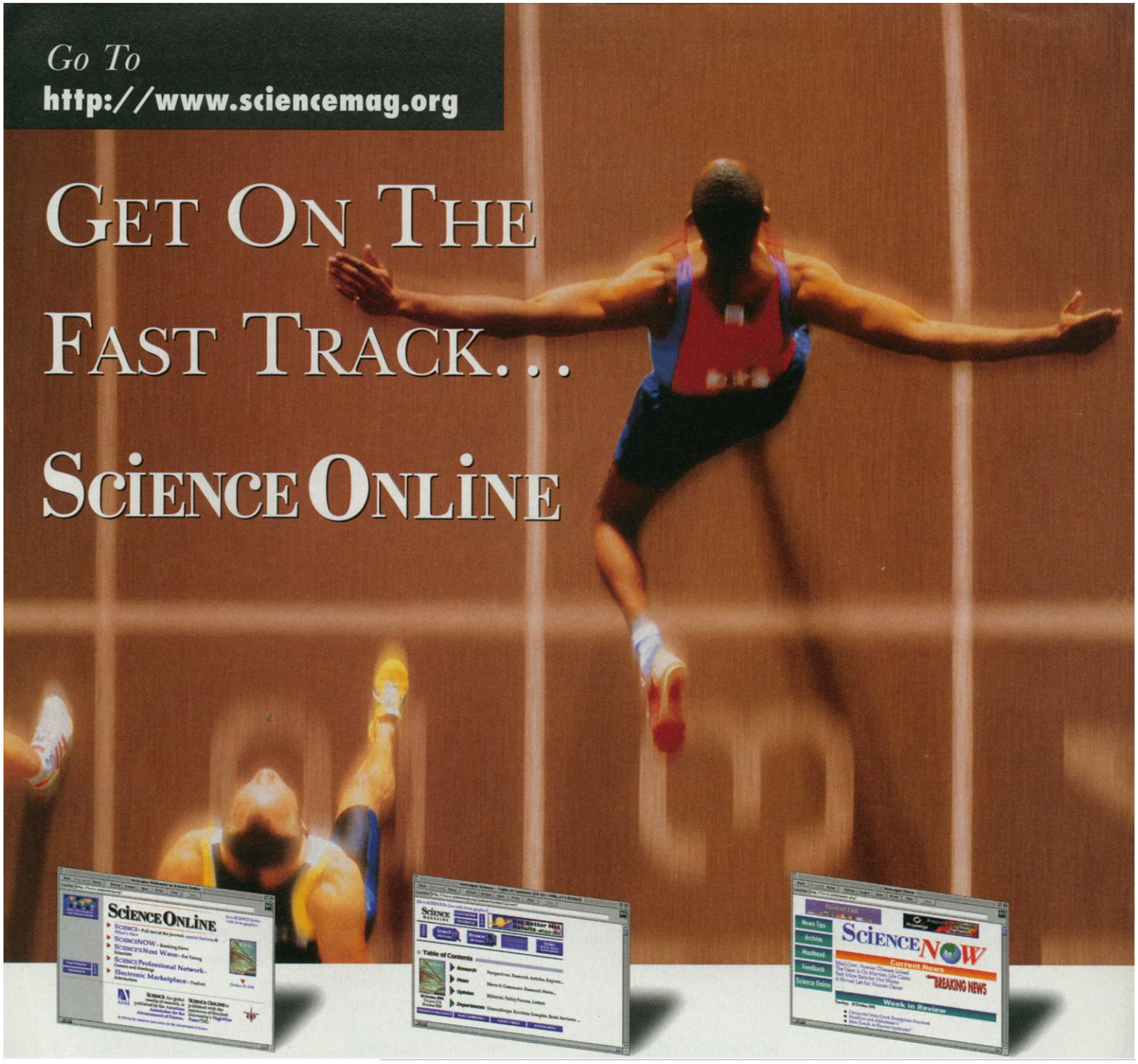
After traumatic brain injury, changes in the permeability of neurons to various ions can contribute to the extent of actual damage to neurons. Zhang *et al.* (p. 1921) show that one part of this change involves the calcium channel known as the NMDA-type glutamate receptor. After neurons have been subjected to traumatic stress, the molecular characteristics of the NMDA receptor change such that the channel becomes more permeable to calcium ions. This influx of calcium ions in turn promotes further neuronal damage.

Tiny test tubes

The inner cavities of carbon nanotubes could be utilized for the controlled production of encapsulated nanostructures and as small test tubes. However, numerous problems remain, such as the controlled filling of the tubes and the reactivity of the tube walls. Ugarte *et al.* (p. 1897) studied the filling of nanotubes with a molten silver salt and showed that a minimum tube diameter of about 4 nanometers is required. The decomposition of the silver salt within the tubes to form silver particles leads to high pressures in the tubes and to production of oxidizing gases that erode the tube walls.

Start me up

Expression of cytokines such as interleukin-4 (IL-4) requires several transcription factors, including members of the NF-AT family (nuclear factor of activated T cells), but low levels of cytokine expression in reconstituted systems suggests that unknown proteins act in NF-AT–mediated transcription. Hodge *et al* (p. 1903) have now identified a protein, NIP45, that shows little similarity to other known proteins, but that, in combination with the NF-AT protein and c-*maf*, activated the IL-4 promoter. Transient overexpression of these proteins in B cells led to endogenous production of IL-4.



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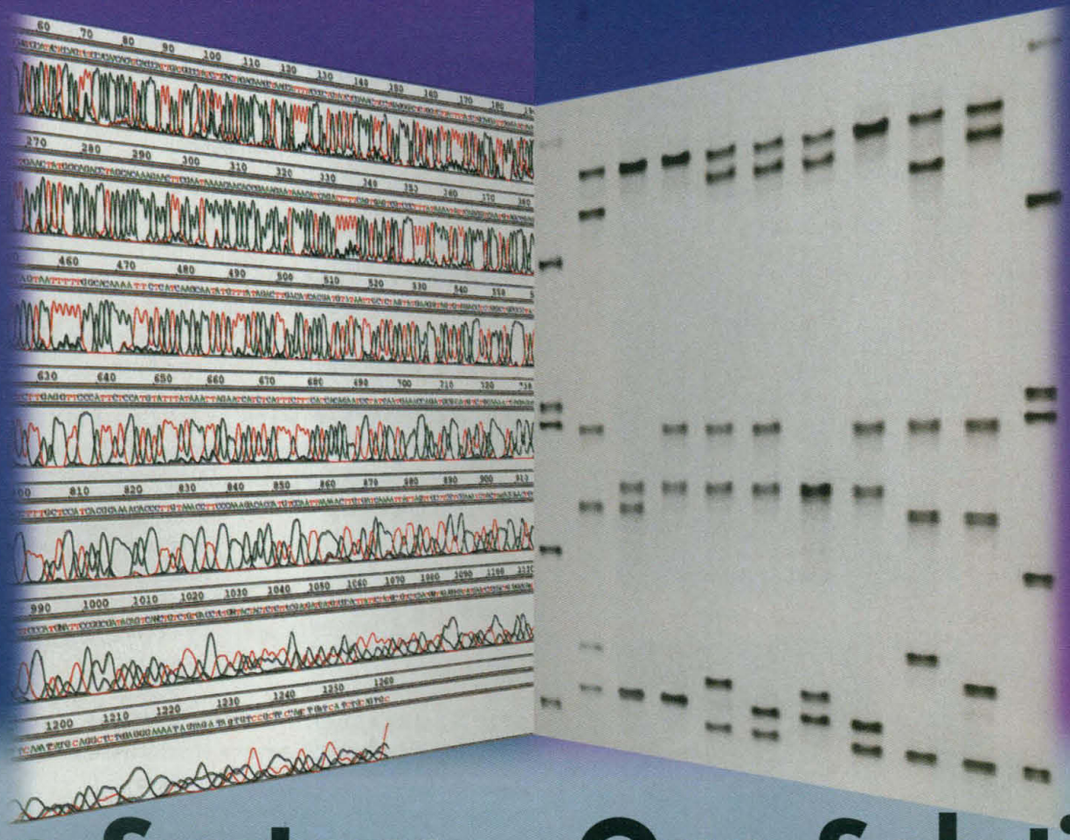

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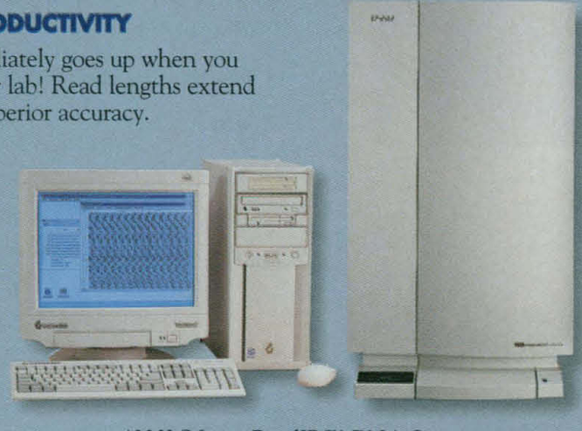

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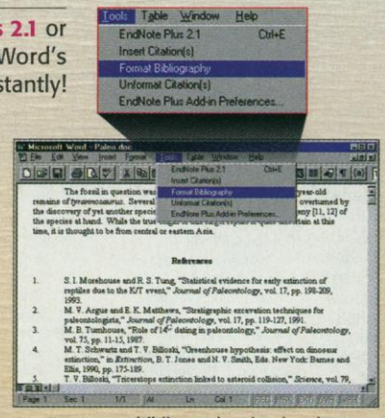

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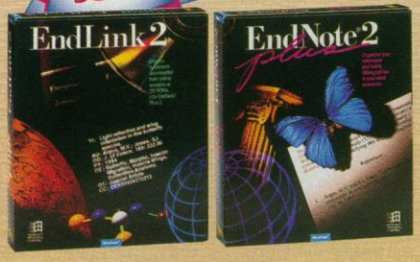

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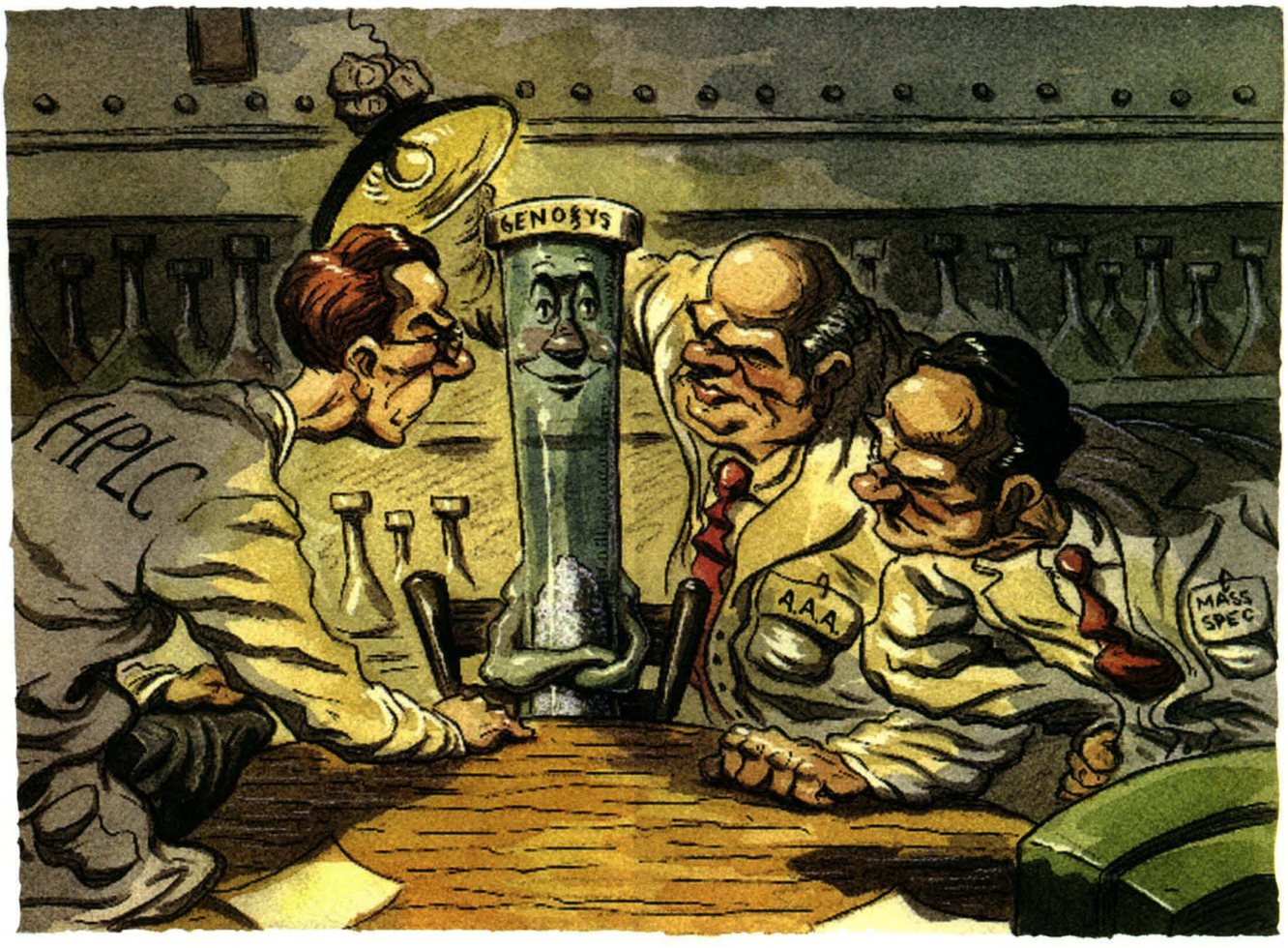

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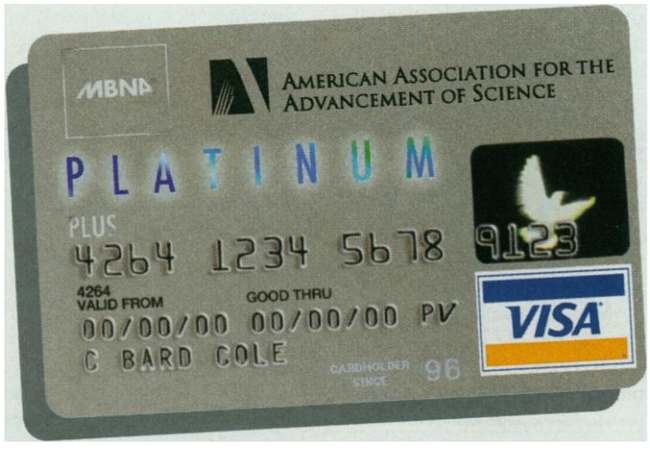

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