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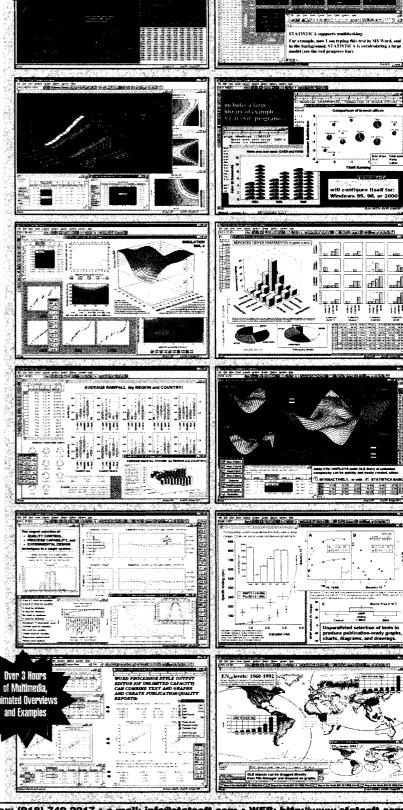
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COVER The adult skeleton is a highly dynamic organ—old bone is continually being destroyed and replaced with new bone. The cellular mechanisms that control this remodeling and new strategies for repairing broken or diseased bone are discussed in a special section beginning on page 1497. The micrograph shows a mouse bone stained with calcein, a fluorescent dye that is incorporated at sites of newly synthesized bone and can be used to measure the rate of bone formation. [Image: M. A. Amling]



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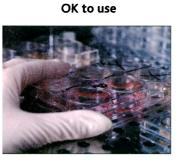
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American Association for the Advancement of Science SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 2000 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$112 (\$62 allocated to subscription). Domestic institutional subscription (51 issues): \$340; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.



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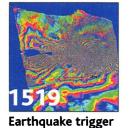
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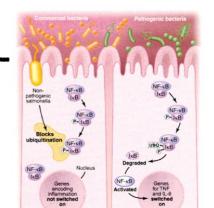
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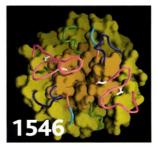
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THIS WEEK IN SCIENCE edited by PHIL SZUROMI

SLIP AND AFTERSLIP

The magnitude 7.5 Izmit earthquake and the subsequent magnitude 7.1 Düzce earthquake were large strike-slip events on the North Anatolian fault in Turkey. This active fault has been studied intently by global positioning system satellites before and after these events, and Reilinger et al. (p. 1519) have modeled the amount and geometry of the subsurface rupture using this data. Large slip occurred in the upper 10 kilometers of the crust in distinct segments, whereas there was little slip at the hypocenter. After the Izmit earthquake, aseismic slip occurred near and below the hypocenter that may have triggered the subsequent Düzce earthquake.

SUPERFLUIDIC MOLECULAR HYDROGEN

Molecular hydrogen can have its nuclear spins parallel (para-hydrogen) or antiparallel (ortho-hydrogen). It has been predicted that para-hydrogen should be superfluidic at low temperatures, just like helium-4. To reach the proposed superfluidic state, however, the liquid has to be extensively supercooled, which has hampered experimental observations. Grebenev *et al.* (p. 1532) used helium droplets as a cool, low-interference spectroscopic matrix, and observed superfluidity in small para-hydrogen clusters.

PUSHING ELECTRONS THE HARD WAY

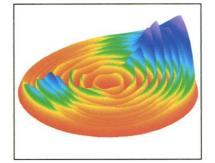
Changes in a material's resistance in a magnetic field (magnetoresistance, or MR) has two parts-the tendency of the electronic orbitals to align in the magnetic field (physical MR) and the magnetic deflection of the electrons from their usually straight path (geometric MR). The former effect, characteristic of the layered manganites, or "giant" or GMR materials, usually dominates the geometric MR. Solin et al. (p. 1530) now show that geometric MR changes greater than five orders of magnitude can be achieved with relatively small magnetic fields using a simple structure: a loop of high-resistance, nonmagnetic indium antimonide with a low-resistance gold filling. In zero magnetic field, the electrons take the easy route through the gold, but a magnetic field forces the electron to take the high-resistance path.

ALL WET

The South American tropics are suspected to have had a major effect on global climate since the last glacial maximum, but there is little agreement over how even one of the most basic climate signals, rainfall, has varied. Betancourt et al. (p. 1542) have constructed a new chronology of precipitation for the central Acatama Desert in Chile based on their surprising discovery of abundant remains of spring vegetation inside fossil rodent middens in what is now one of the driest places on Earth. Their record, supported by data on the rise and fall of the water table in nearby wetland deposits, differs in several important ways from other climate reconstructions for neighboring regions, and raises questions about what ultimately drives the long-term variability of the South American summer monsoon.

INSERT ATOM HERE

One goal of chemical reaction dynamics is to see how the different rotational and vibrational states of a molecule influence its reactivity. Most of these studies have focused on simple abstraction reactions, such as $H_2 + F \rightarrow H + HF$, in which an incoming atom approaches



a molecule in a linear geometry. Liu *et al.* (p. 1536) have examined the reaction of a particular atomic state of oxygen, $O(^{1}D)$, with *para*-H₂, for energies at which the O atom inserts itself into the H₂ bond to form OH and H in a "tee-shaped" geometry at high resolution. Although the overall reaction is symmetrical in the forward and backward directions, individual rotational and vibrational states can exhibit strikingly different angular distributions.

KEEPING CHOLESTEROL IN CHECK

Controlling the absorption of dietary cholesterol from the digestive tract is an integral part of maintaining whole-body cholesterol homeostasis. Repa *et al.* (p. 1524; see the news story by Ferber) report that certain nuclear steroid receptors regulate this process. One nuclear receptor heterodimer stimulates the expression of

a transmembrane protein of the ABCbinding cassette family and facilitates cholesterol efflux from intestinal cells. Another receptor heterodimer decreases the pool of bile acids in the liver, molecules that are needed to absorb free cholesterol. These activities serve to reverse cholesterol transport and decrease absorption of cholesterol and further expand the roles of nuclear steroid receptors in maintaining cholesterol homeostasis.

ROLL OUT THE HALF BARREL

The existence of similar domains in multidomain proteins indicates that they have evolved through gene duplication and fusion. Now Lang et al (p. 1546; see the Perspective by Miles and Davies) show that the single-domain β/α barrel likely evolved by duplication and fusion of the gene of a half-barrel ancestor. They determined the structures of two enzymes in the histidine biosynthesis pathway, HisA and HisF, at resolutions of 1.85 and 1.45 angstroms, respectively. Structural and sequence analysis strongly suggest that these two eightfold β/α barrels evolved from a common half-barrel ancestor. They suggest that an initial gene duplication would give two half-barrels that are then fused and adapted into an ancestral β/α barrel. A second gene duplication could lead to diversification into two enzymes with distinct catalytic activities.

ANTI-AGING PILLS FOR WORMS

Reactive oxygen species, a normal byproduct of cellular metabolism, are involved in the normal aging of cells and in age-related diseases. Melov et al. (p. 1567) have tested the effects of two small synthetic molecules that mimic the activities of superoxide dismutase and catalase (two enzymes known to "disarm" oxygen free radicals) on the longevity of adult worms. Growing worms in medium containing mimetics extended worm life-span by as much as 54%. The mimetics reversed the accelerated aging of worms carrying a mutation in the mev-1 gene encoding a mitochondrial electron transport protein.

NATURE'S CURE FOR AN UPSET STOMACH

How does the gut, with its high load of microbes, normally avoid high levels of inflammation of its cellular lining? Neish *et al.* (p. 1560; see the Perspective by Xavier and Podolsky) show that certain bacteria present in the gut, upon binding to epithelial CONTINUED ON PAGE 1431



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This Week in Science

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cells, can inhibit the movement of the proinflammatory protein NF- κ B to the cell nucleus, where it would normally activate a cascade of genes leading to inflammation. This inhibition occurs indirectly by preventing the ubiquitination and, hence, the degradation of I κ B- α , which inhibits the action of NF- κ B by anchoring it firmly in the cytoplasm. The results provide insight into how host adaptations to the gut microflora benefit both host and microbe.

INHIBITED JUST ENOUGH

The transcription factor NF-kB is a key mediator of the inflammatory response in mammals, and NF-KB inhibitors are of potential therapeutic value. A protein kinase complex containing the two IkB kinases IKK α and IKK β and the regulatory protein NEMO (or IKKγ) causes activation of NF-κB in response to various inflammatory stimuli. (IκB is an inhibitor of NF-κB; when IκB is phosphorylated, its inhibition of NF-kB is relieved.) Thus, the IKKs are prime targets for therapeutic intervention, but inhibition of catalytic activity of kinases without affecting other similar enzymes can be difficult (or even harmful, because small amounts of NF-kB protect cells from apoptosis). May et al. (p. 1550) found that NEMO interacts with a very small region of the IKKs and that the interaction can be interrupted by a small peptide. When interaction of the IKKs with NEMO is disrupted, activation of NF-kB is effectively inhibited, but the beneficial basal activity of NF-kB is retained. The inhibitory peptide reduced inflammatory responses in two mouse models.

NO WEEDS-BUT NO BIRDS?

Part of the debate surrounding genetically modified (GM) crops concerns the possibility of unanticipated environmental effects. Watkinson et al. (p. 1554; see the Perspective by Firbank and Forcella) present a model analysis of the potential impact of herbicidetolerant crops on weed and bird populations. Their analysis consists of the linkage between a dynamic model of weed population at the field scale that includes parameters for crop management, a frequency distribution of weed levels across fields, and a model of the response of a bird species to these frequency distributions. The simulation of herbicide application results in severe reduction of weed populations that eventually affects the populations of seed-eating birds.

A SPECIAL SENSE OF SMELL

The vomeronasal organ of mammals is a specialized structure in the nose that deals with the detection of pheromones. Little is known about how vomeronasal neurons react to natural stimuli and how they code their information for transmission to higher processing areas in the brain. Holy et al. (p. 1569) simultaneously recorded from a large number of mouse vomeronasal neurons and found that these cells responded to highly diluted components found in the urine of mice. Many individual neurons were highly selective for either male or female urine. Their activation required the recruitment of an intracellular signaling cascade involving phospholipase C. Unlike most sensory neurons, vomeronasal neurons did not adapt when exposed to a stimulus for a long time.

TECHNICAL COMMENT SUMMARIES

Does Rydberg State Manipulation Equal Quantum Computation?

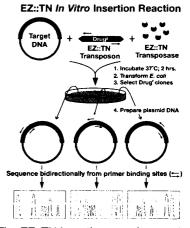
The full text of these comments can be **seen at** www.sciencemag.org/cgi/content/full/289/5484/1431a

Ahn *et al.* (Reports, 21 January 2000, p. 463) reported results of experiments in which information was stored as quantum phase in a Rydberg atom data register, and showed that the information could be retrieved using a single laser pulse, in keeping with theoretical predictions. Meyer and Kwiat and Hughes note in separate comments that, because of unfavorable scaling characteristics, the system described by Ahn *et al.* cannot implement quantum algorithms more efficiently than can a classical digital computer, and thus cannot really be considered quantum computing. Kwiat and Hughes also suggest that the Ahn *et al.* system did not achieve quantum interference, and that their procedure thus did not accomplish inversion about the mean (IOM), a key feature in the search algorithms that the experiments sought to implement.

Bucksbaum *et al.*, in their response, acknowledge the scaling limitations of their setup and suggest some possible ways to overcome them in future experiments. They also disagree with the assertion by Kwiat and Hughes that interference "is not a general feature of these atomic wave packet experiments," and argue that their procedure, irrespective of whether it followed the specifics of IOM, accomplished the same result. Notwithstanding unfavorable scaling for very large computational problems, they conclude, the Ahn *et al.* experiments "constitute progress that can...stimulate greater understanding and further developments in this field."

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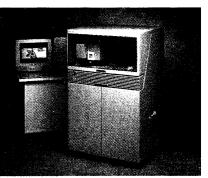
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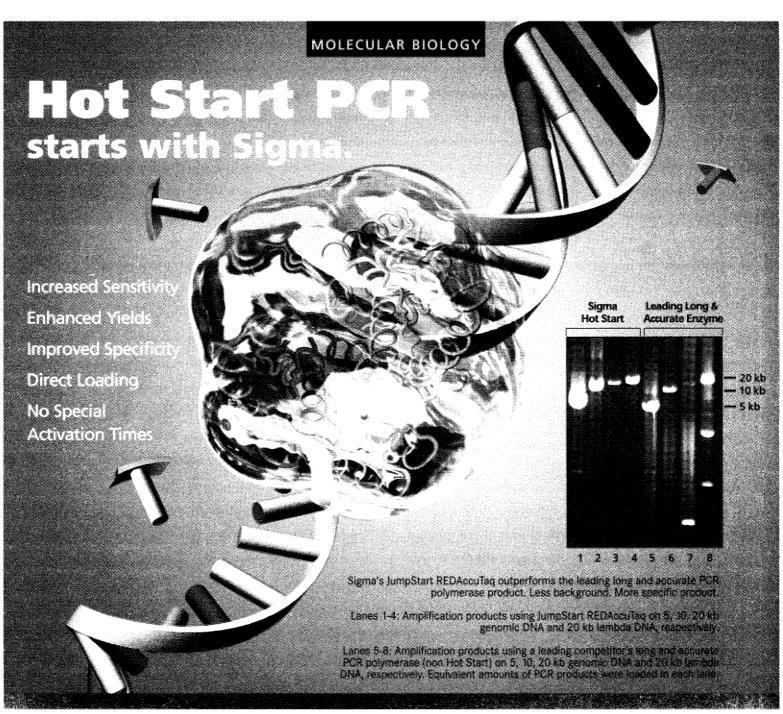
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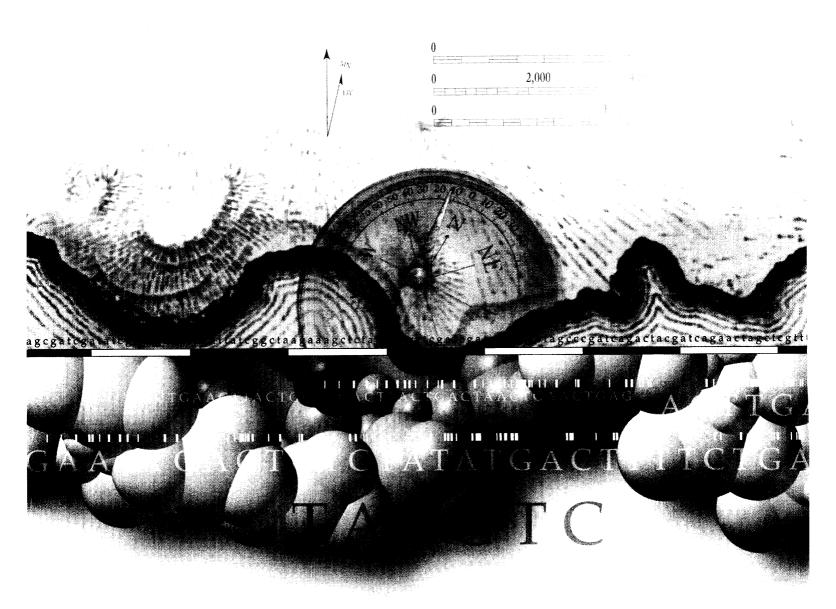
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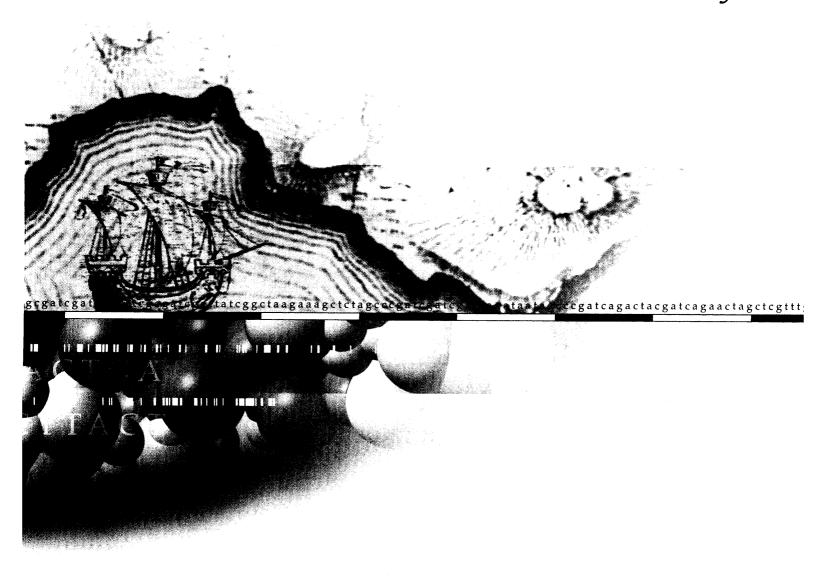


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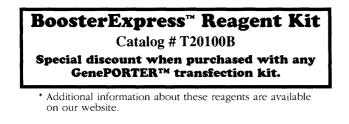
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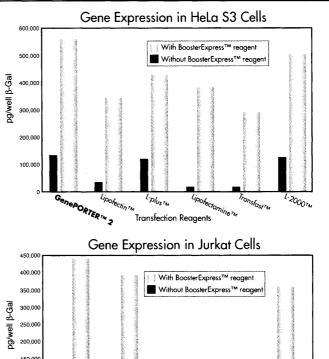
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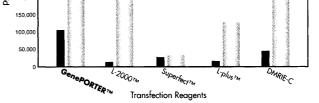
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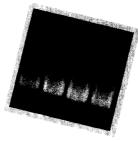
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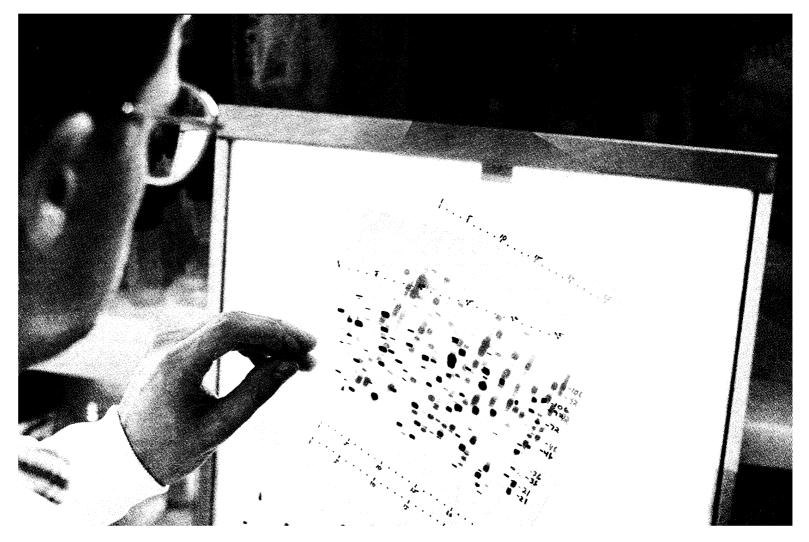


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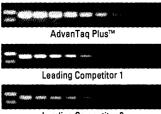
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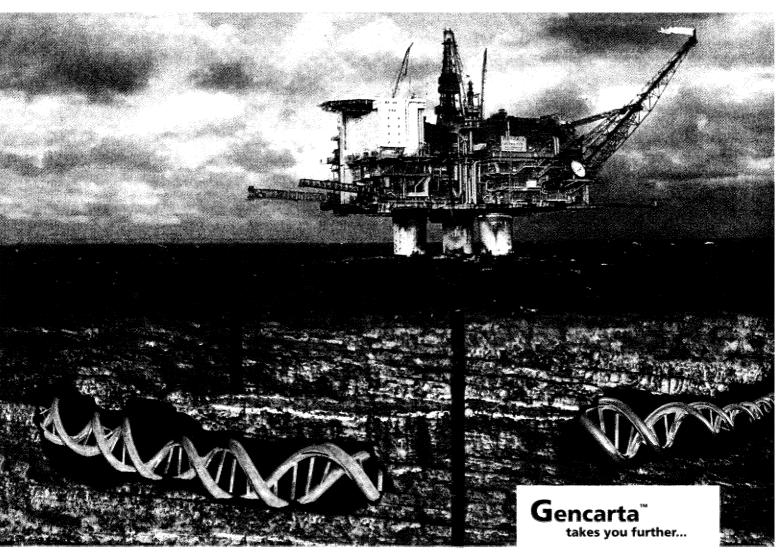
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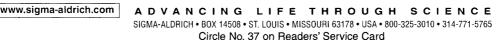
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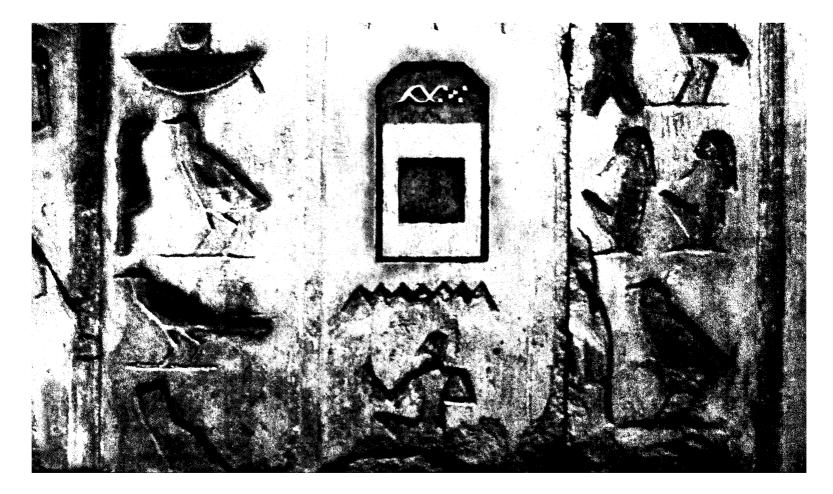
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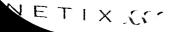
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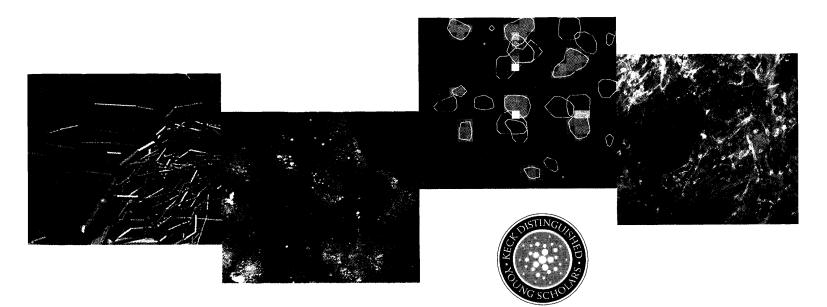
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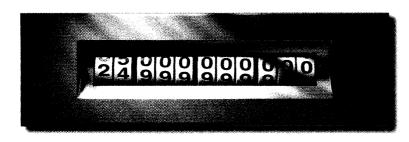
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away from the east coast by the middle of the 14th century (4). The few dated inland Canterbury sites, such as a small kill site near Lake Coleridge (Wk-6766, 2σ calibrated age 1305–1434 A.D. on moa bone protein) (5), are consistent with our model (6).

At Italian Creek, two of three calibrated dates have ranges that overlap with the age range predicted by our model described in our report. Those dates cannot falsify the model. The third (NZ-4715) extends only to 1432, within the upper limit allowed by our model.

Furthermore, the burnt moa eggshell was not necessarily associated with human occupation. No moa bone was reported from the site, and unrecognized mixing of natural and archaeological artefacts in such shelters is not unknown. Many rock shelters in New Zealand have natural fossil faunas; many were also moa nest sites (6, 7).

The 25 additional archaeological sites Anderson mentions might have dates for which error ranges reach the 15th century, but most, if not all, have dates that are predominantly within the 14th century. For example, NZA-825 on alkali-treated moa bone collagen (3) from the bottom of the basal layer at Tumbledown Bay (8) is both equivocally associated with the dated occupation

SCIENCE'S COMPASS

and possibly too young. NZ-7739 from Shag River Mouth, used by Anderson to support late hunting, is from a suite of dates on moa bone collagen previously discarded as being too variable and subject to error (9). From dates on other materials, it was concluded that moa hunting there lasted a few decades in the mid to late 14th century (10).

The spread of possible calendar dates arising from the calibration process precludes inference of a date for the end of moa hunting. Hence, we chose to date the earliest site where moa were not available in the environment, so "capping" the moa hunting period.

R. N. Holdaway

Palaecol Research, 167 Springs Road, Hornby, Christchurch 8004, New Zealand. E-mail: piopio@ netaccess.co.nz

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- 10. A. J. Anderson and I. Smith, in (9), chap. 20.

CORRECTIONS AND CLARIFICATIONS

Reports: "*PAX8-PPAR* γ 1 fusion oncogene in human thyroid carcinoma" by T. G. Kroll *et al.* (25 Aug., p. 1357). The title of this report was incorrect when published. Two words in the title, "oncogene" and "in," were mistakenly transposed during the editing process.

News Focus: "Creation's seventh day" by Robert F. Service (14 July, p. 232). The spacefilling model of DNA on page 235 and repeated in the Table of Contents (p. 208) was printed incorrectly. It should have depicted a right-handed helix instead of the left-handed one shown.

Random Samples: "Head count" (12 May, p. 959). The affiliation of Jeffrey Lieberman in the accompanying table was incorrect. He is at the University of North Carolina.

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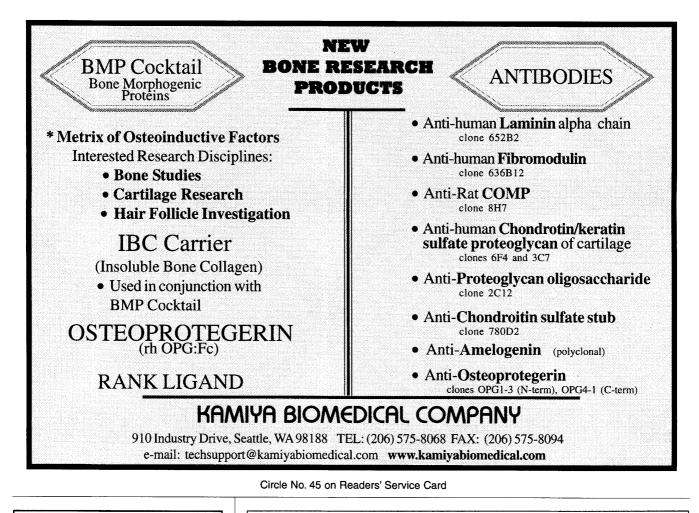
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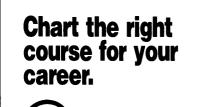
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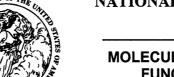








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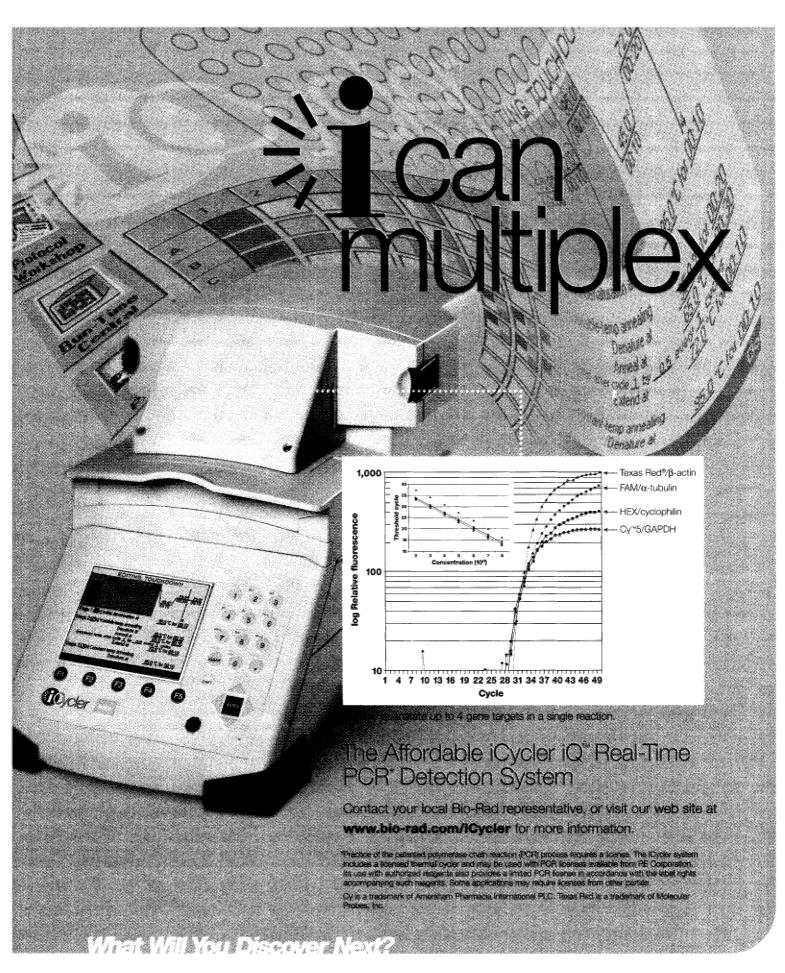


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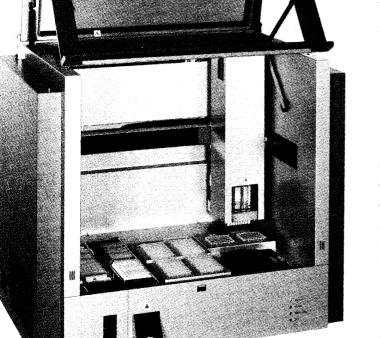




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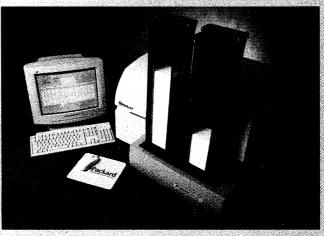
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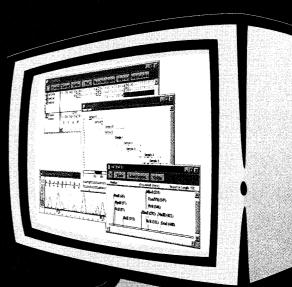
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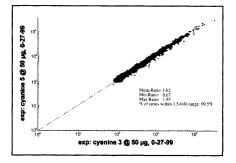
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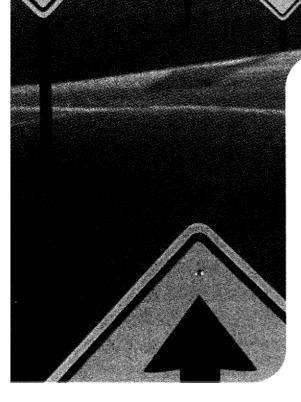
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PCR clean-up. Why waste

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Fig. 1. Fluorescent sequencing results of a 100 bp pUC18 PCR fragment sequenced with a -20 Fwd primer using the DYEnamic ET Terminator Cycle Sequencing Kit (Amersham Pharmacia Biotech). Data generated for USB by Cleveland Genomics (clevelandgenomics.com), a research service company. PCR clean-up performed with: (a) ExoSAP-IT; (b) a column designed for PCR clean-up. Base miscalls in (b) are due to inherently low yields of short PCR products when using columns.

Fig. 2. Autoradiograms of a 20.7 kb Lambda PCR fragment sequenced with MBL202 Fwd primer using USB's Thermo Sequenase Radiolabeled Terminator Cycle Sequencing Kit. PCR clean-up performed with: (a) ExoSAP-IT; (b) a column designed for PCR clean-up.

BATCCCCG G GETACC GAG CP OG A ATTC GT AATCAT GT CAT A 30 40 50 60 Fig. 1(a) GATCCCCGGGITACCGAGCNCGAATTCGINAATCATGTCAT# 30 40 50 60 Fig. 1(b)

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Eig. 2(a)

Eig. 2(b)

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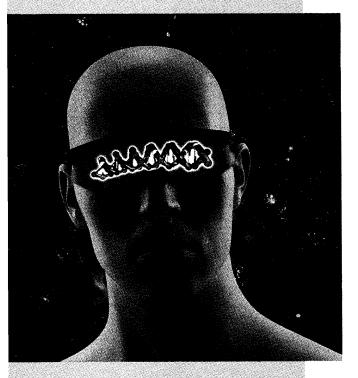


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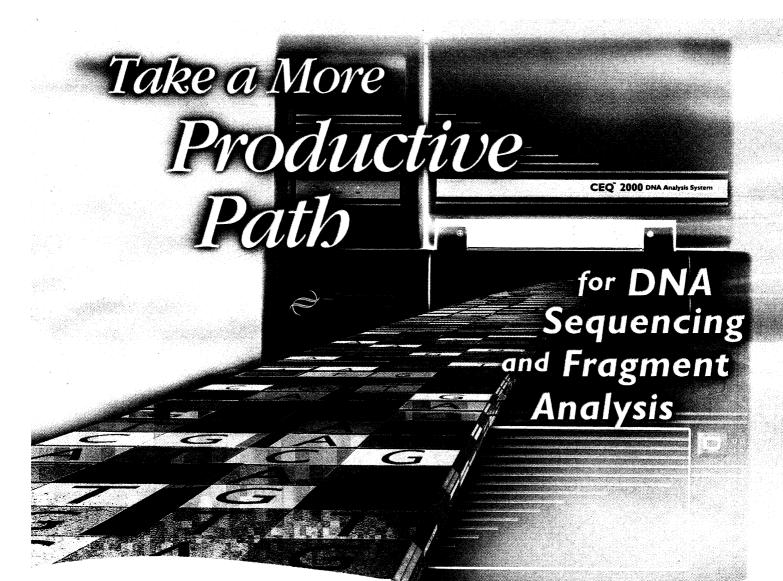
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