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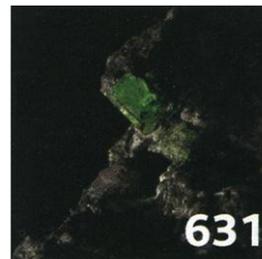
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COVER An emerald in its gangue. This crystal (5 mm in length) is from the main Colombian mine of Coscuez. The oxygen isotopic ratio of Coscuez emeralds is diagnostic and can be used to trace the origin of historical gems, especially "old mine" emeralds that were cut in the 18th century in India. [Photograph: Hervé Conge; reprinted with permission from Association Française de Gemmologie, CNRS, IRD]



568

Rancor over rankings

NEWS

NEWS OF THE WEEK

- 558 **2001 BUDGET: Clinton Seeks 'Major Lift' in U.S. Research Programs**
- 559 **PATENTS: Company Gets Rights to Cloned Human Embryos**
- 561 **OPTOELECTRONICS: Blue Semiconductors Settle on Silicon**
- ▼ 562 **GEOLOGY: Discovering the Original Emerald Cities**
631
- ▼ 562 **CELL BIOLOGY: Generating New Yeast Prions**
661
- 563 **SCIENTIFIC PUBLISHING: Publishers Discuss European E-Print Site**
- 564 **ORGANIC CHEMISTRY: Cubic Compound Makes a Bigger Bang**
- 565 **RESTORATION ECOLOGY: Bringing the Salton Sea Back to Life**
- 565 **CLINICAL RESEARCH: FDA Halts All Gene Therapy Trials at Penn**
- 567 **INTELLECTUAL PROPERTY: NIH Cuts Deal on Use of OncoMouse**
- 567 **PASTEUR INSTITUTE: New Chief Promises Renewal and Openness**

NEWS FOCUS

- 568 **EDUCATION: Graduate Educators Struggle to Grade Themselves**
Support Grows for British Exercise to Allocate University Funds
- 570 **SOCIETY FOR INTEGRATIVE AND COMPARATIVE BIOLOGY: An Integrative Science Finds a Home**
- 572 **ASTROPHYSICS: Heretical Idea Faces Its Sternest Test**
- 573 **RESTORATION ECOLOGY: Returning America's Forests to Their 'Natural' Roots**
- 576 **AMERICAN GEOPHYSICAL UNION: Quakes Large and Small, Burps Big and Old**

DEPARTMENTS

NETWATCH
543

THIS WEEK IN SCIENCE
545

EDITORS' CHOICE
549

CONTACT SCIENCE
554

SCIENCESCOPE
561

RANDOM SAMPLES
579

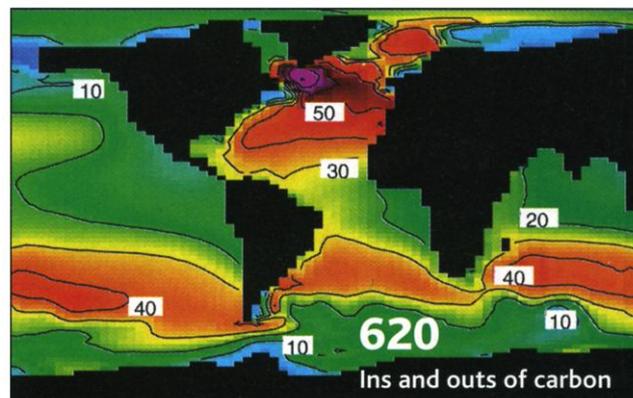
NEW PRODUCTS
671

AAAS NEWS AND NOTES
672

RESEARCH

REPORTS

- 617 **Tropical Pacific Forcing of Decadal SST Variability in the Western Indian Ocean over the Past Two Centuries** J. E. Cole, R. B. Dunbar, T. R. McClanahan, N. A. Muthiga
- 620 **The Role of the Southern Ocean in Uptake and Storage of Anthropogenic Carbon Dioxide** K. Caldeira and P. B. Duffy
- 622 **Nanotube Molecular Wires as Chemical Sensors** J. Kong, N. R. Franklin, C. Zhou, M. G. Chapline, S. Peng, K. Cho, H. Dai
- 625 **Single-File Diffusion of Colloids in One-Dimensional Channels** Q.-H. Wei, C. Bechinger, P. Leiderer
- ▼ 627 **Three-Dimensional Direct Imaging of Structural Relaxation Near the Colloidal Glass Transition** E. R. Weeks, J. C. Crocker, A. C. Levitt, A. Schofield, D. A. Weitz
604
- ▼ 631 **Oxygen Isotopes and Emerald Trade Routes Since Antiquity** G. Giuliani, M. Chaussidon, H.-J. Schubnel, D. H. Piat, C. Rollion-Bard, C. France-Lanord, D. Giard, D. de Narvaez, B. Rondeau
562
- 633 **Quantum-Critical Conductivity Scaling for a Metal-Insulator Transition** H.-L. Lee, J. P. Carini, D. V. Baxter, W. Henderson, G. Grüner
- 637 **Strength and Breaking Mechanism of Multiwalled Carbon Nanotubes Under Tensile Load** M.-F. Yu, O. Lourie, M. J. Dyer, K. Moloni, T. F. Kelly, R. S. Ruoff



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EDITORIAL

589 Unseemly Competition

LETTERS

591 E-Knowledge Hullabaloo—Or When Will the Glass Spill Over? H. Kende. *Gene Therapy on Trial* H. I. Miller. *Sickle Cell Anemia Therapy: Progress Since Pauling* A. N. Schechter and G. P. Rodgers. *Response* B. J. Strasser. *Room-Temperature Hydrogen Storage in Nanotubes* M. J. Heben and A. C. Dillon. *Response* H. M. Cheng and M. S. Dresselhaus. *Corrections and Clarifications*

POLICY FORUM

595 MEDICAL RESEARCH: Oversight Mechanisms for Clinical Research R. Snyderman and E. W. Holmes

BOOKS ETAL.

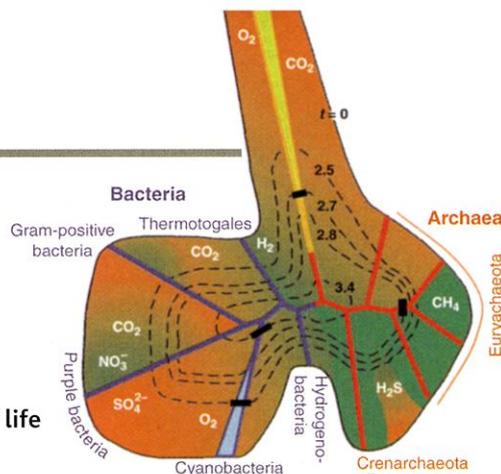
598 BIOETHICS: *Undue Risk Secret State Experiments on Humans* J. Moreno, reviewed by M. S. Lindee

599 TECHNOLOGY: *Absolute Zero and the Conquest of Cold* T. Shachtman, reviewed by D. Goodstein

PERSPECTIVES

▼ 601 667 EPIDEMIOLOGY: Simple Rules with Complex Dynamics R. May

605 Coevolution of life and Earth



602 AIDS: HIV Infection and Dementia S. Gartner

▼ 604 627 MATERIALS SCIENCE: Movies of the Glass Transition M. D. Ediger

605 EARTH SCIENCE AND EVOLUTION: Genomics and the Geosciences J. F. Banfield and C. R. Marshall

REVIEW

607 AIDS: AIDS as a Zoonosis: Scientific and Public Health Implications B. H. Hahn, G. M. Shaw, K. M. De Cock, P. M. Sharp

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640 Cloning and Heterologous Expression of the Epithelone Gene Cluster L. Tang, S. Shah, L. Chung, J. Carney, L. Katz, C. Khosla, B. Julien

643 Complementary Neural Mechanisms for Tracking Items in Human Working Memory Y. Jiang, J. V. Haxby, A. Martin, L. G. Ungerleider, R. Parasuraman

646 Inhibitors of Strand Transfer That Prevent Integration and Inhibit HIV-1 Replication in Cells D. J. Hazuda, P. Felock, M. Witmer, A. Wolfe, K. Stillmock, J. A. Grobler, A. Espeseth, L. Gabryelski, W. Schleif, C. Blau, M. D. Miller

650 A Tale of Two Futures: HIV and Antiretroviral Therapy in San Francisco S. M. Blower, H. B. Gershengorn, R. M. Grant

655 Redox Signaling in Chloroplasts: Cleavage of Disulfides by an Iron-Sulfur Cluster S. Dai, C. Schwendtmayer, P. Schürmann, S. Ramaswamy, H. Eklund

658 Voltage- and Tension-Dependent Lipid Mobility in the Outer Hair Cell Plasma Membrane J. S. Oghalai, H.-B. Zhao, J. W. Kutz, W. E. Brownell

▼ 661 562 Creating a Protein-Based Element of Inheritance L. Li and S. Lindquist

664 Coupling of Stress in the ER to Activation of JNK Protein Kinases by Transmembrane Protein Kinase IRE1 F. Urano, X. Wang, A. Bertolotti, Y. Zhang, P. Chung, H. P. Harding, D. Ron

▼ 667 601 A Simple Model for Complex Dynamical Transitions in Epidemics D. J. D. Earn, P. Rohani, B. M. Bolker, B. T. Grenfell

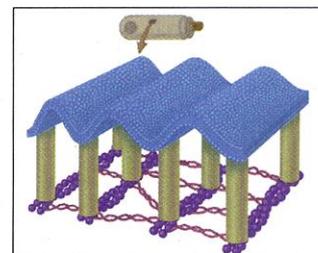
TECHNICAL COMMENTS

Questions About Magnetic Lineations in the Ancient Crust of Mars

C. G. A. Harrison. *Response* J. E. P. Connerney, M. H. Acuña, P. J. Wasilewski, N. F. Ness, H. Rème, C. Mazelle, D. Vignes, R. P. Linn, D. L. Mitchell, P. A. Cloutier
www.sciencemag.org/cgi/content/full/287/5453/547a

Neck Posture of Sauropod Dinosaurs P. Upchurch. *Response* K. A. Stevens and J. M. Parrish

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658

Flexible membranes in the inner ear

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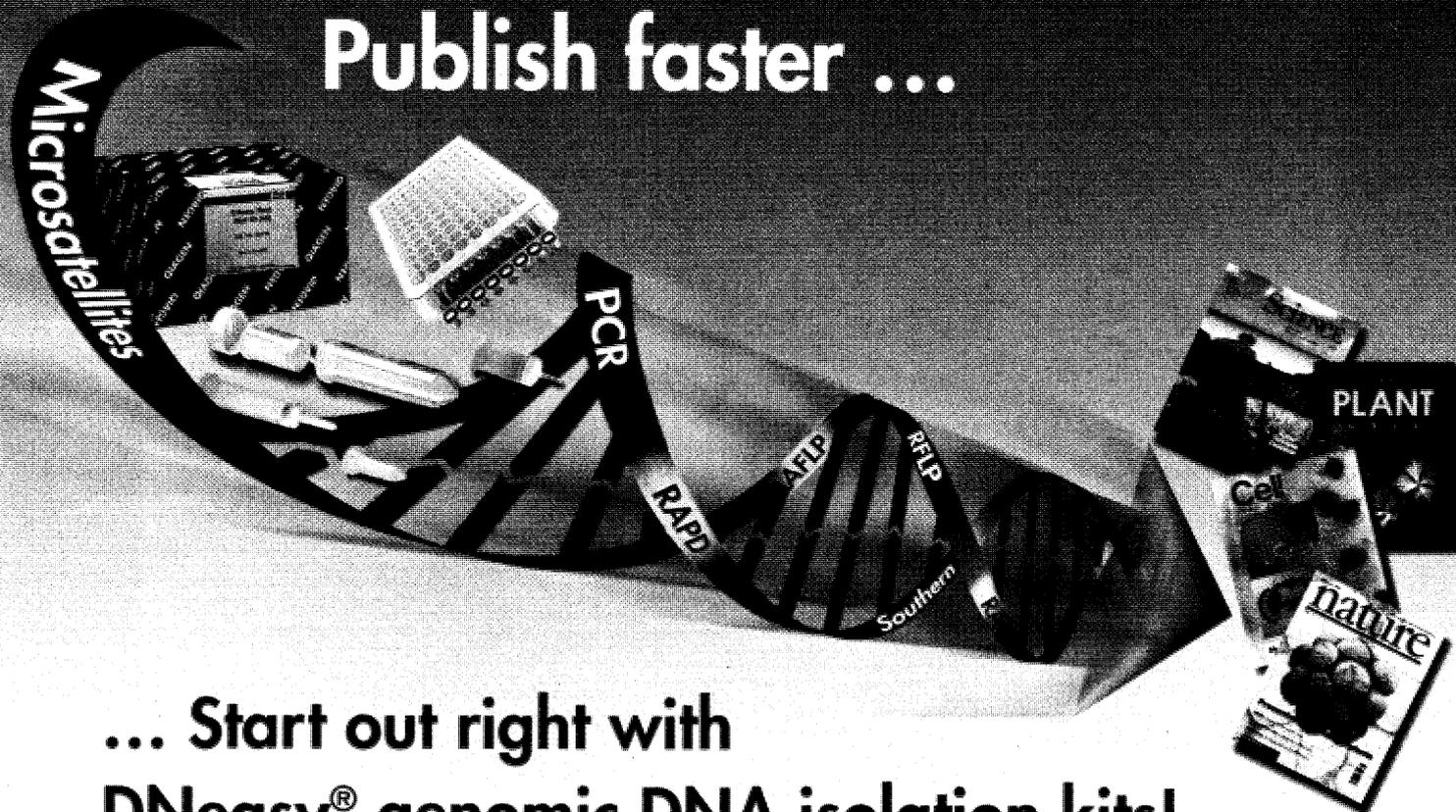
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IMMUNODEFICIENCY VIRUS TRANSMISSION ACROSS SPECIES

The human immunodeficiency viruses (HIV-1 and HIV-2) entered the human population as viruses that crossed over from nonhuman primates. Hahn *et al.* (p. 607) review the evidence for the origin of the viruses that led to the AIDS epidemic. They also sound a cautionary note—26 different nonhuman primates are known to harbor simian immunodeficiency viruses and could give rise to new viral crossover events.

TRANSOCEANIC COMMUNICATIONS

Two of the major climate cycles with tropical origins that can have global effects are the El Niño–Southern Oscillation, or ENSO, and the Asian and African monsoons. Whether they are connected has been uncertain; one problem has been that the instrumental record, particularly of sea surface temperatures (SSTs), is short. Cole *et al.* (p. 617) now provide a long-term coral record of SSTs from the western Indian Ocean. Comparison with other coral records and ENSO records implies that the climate in the Pacific, which is heavily influenced by ENSO, strongly affects the climate in the Indian Ocean.

EMERALD TRAILS

Some of the most valuable gems throughout history have been emeralds, yet in many cases the origins of the most precious emeralds have been obscure. Giuliani *et al.* (p. 631; see the cover and the news story by Stokstad) analyzed the oxygen isotopes of some of the world's most famous emeralds, including the central jewel of the crown of France, to trace the origins of emeralds worldwide since antiquity. Ion microprobe analyses allow analysis without harming the quality of the gems. Because emerald deposits worldwide show a huge variation in oxygen isotopes, specific origins can be identified. The data show that trade in early emeralds involved, surprisingly, sources in Pakistan, and reveal the rapid infiltration of emeralds from Columbia soon after their discovery in the early 1500s.

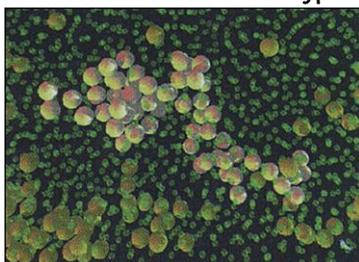
NANOTUBE SENSORS

Sensors for gaseous molecules such as NO₂ and NH₃ are used in environmental monitoring, industry, medicine, and many other fields. Traditional solid-state sensors require relatively high temperatures to achieve significant sensitivity for these

molecules. Kong *et al.* (p. 622) show that single-wall carbon nanotubes can be used as miniaturized chemical sensors at room temperature. The electrical resistance of individual semiconducting nanotubes can change by up to three to four orders of magnitude upon exposure to NO₂ or NH₃. Chemical selectivity can be achieved by adjusting the electrical gate voltage.

GLASSES IN 3D

In the supercooled fluid and glassy states, particle motions become restricted and structural relaxation (rearrangements of cages of particles) is thought to occur through the cooperative movements of clusters of particles. Direct evidence for this hypothe-



sis is difficult to obtain for molecule fluids, but the motion of particles in colloidal systems is within the resolution of confocal microscopy. Weeks *et al.* (p. 627; see the Perspective by Ediger) present three-dimensional images of particle motions in colloidal glasses. They find that the fastest particles move cooperatively and that the size of mobile particle clusters grows in supercooled liquids as the glass transition is approached, but then drops sharply at the glass transition.

PUTTING NANOTUBES ON THE RACK

Most studies of carbon nanotube strength have examined sideways bending. Yu *et al.* (p. 637) looked at what happens when multiwall carbon nanotubes (MWNTs) are pulled along their length until they break. They attached MWNTs to two opposing atomic force microscope tips, which themselves were mounted in a scanning electron microscope. Thus, they could measure stress-strain curves while recording images of the fracture processes. The outermost wall broke and the coaxial tubes pulled apart like a sword from its sheath—the length of the two ends often exceeded the initial length. Subsequent

transmission electron microscopy of the fragments revealed a variety of deformation processes.

EPOTHILONE EXPRESSION

Epothilone is a microbial compound that appears to possess efficacy in the treatment of certain types of cancer. Pharmaceutical development of specific and useful derivatives has been hampered by availability; the chemical synthesis is lengthy and laborious, and the natural source is not amenable to biochemical or genetic manipulation. Tang *et al.* (p. 640) describe the cloning of the gene cluster responsible for the biosynthesis of epothilone and its expression in a suitable host where molecular tinkering is feasible.

I KNOW IT'S RIGHT ALONG HERE...

Searching for a familiar book in one's library evokes a variety of neural responses in the brain. Jiang *et al.* (p. 643) show that the early stages of visual processing are activated less and less as one scans across bookshelves because the same type of visual scene is treated as a repetitive and familiar stimulus. However, frontal cortex areas that subserve working memory display an enhanced activity, which serves as a marker of top-down specification of a particular and precise visual pattern. Taken together, these changes make it possible to ignore irrelevant, distractor books and to recognize the target book efficiently.

EPIDEMIC DYNAMICS—PAST

Epidemiological investigations can provide important insights into population biology because such studies can rely on long-term public health records involving large population sizes. Using a simple nonlinear model, Earn *et al.* (p. 667; see the Perspective by May) explain a series of remarkable global changes in patterns of measles epidemics in which transitions occurred between regular synchronized cycles and irregular unsynchronized patterns. They accurately reproduced changes in patterns of epidemics on the basis of changes in birth and vaccination rates. This work establishes that the source of the dynamical transitions is extrinsic, rather than any intrinsic property of the dynamics themselves. Slow changes in extrinsic factors can stimulate quite sudden shifts in measles population dynamics.

EPIDEMIC DYNAMICS—FUTURE

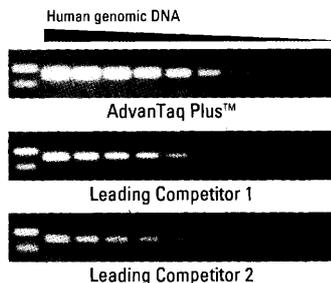
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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 545

fectious disease can affect an entire population. There has been uncertainty regarding the effects of antiretroviral therapy (ART) in light of (i) the continued ability of some treated individuals (especially for monotherapy) to transmit the virus, (ii) the development of resistant strains, and (iii) the possibility that risky behaviors could increase. Blower *et al.* (p. 650) have modeled these possibilities for the San Francisco gay community during the next 10 years. They found that increasing the use of ART would decrease the death rate and prevent a substantial number of new infections, even in the presence of drug resistance and risky behavior.

TARGETING HIV INTEGRATION

Integration of human immunodeficiency virus-type 1 (HIV-1) DNA into the host genome is a key step in virus replication that makes it an attractive target in designing antiretroviral drugs. However, the search for an inhibitor that would be an effective antiviral agent has proven frustrating. Hazuda *et al.* (p. 646) determined that certain 1,3-diketo acids can inhibit HIV-1 integrase activity at a step in the integration process, called strand transfer, that has not been affected by previous inhibitors. Finding that the active site of HIV-1 integrase can be recognized in dif-

ferent ways during integration should help promote the identification of medically relevant integrase inhibitors.

PRYING OPEN PRION SECRETS

The prion proteins of yeast, although unrelated to those of mammals, show similar characteristics in that they can undergo a conformational change that alters the phenotype of the cell, and this altered phenotype can be passed on to daughter cells. Hence, the conformation of yeast prions (as is the case with mammalian prions) should encrypt heritable information without the help of a nucleic acid intermediate. Li and Lindquist (p. 661; see news story by Balter) now elegantly show that prion-like properties can be transferred from a prion to another totally unrelated protein. The investigators fused the amino-terminal and M regions of the Sup35 yeast prion protein to the rat glucocorticoid receptor (a transcription factor that is regulated by steroid hormones). When endogenous Sup35 acquired an altered conformation, this conformational change was conferred on the Sup35 portion of the fusion protein. Not only Sup35 activity but also that of the glucocorticoid receptor was altered, as shown by the reduced ability of the fusion protein to activate transcription.

TECHNICAL COMMENT SUMMARIES

Questions About Magnetic Lineations on Mars

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/287/5453/547a

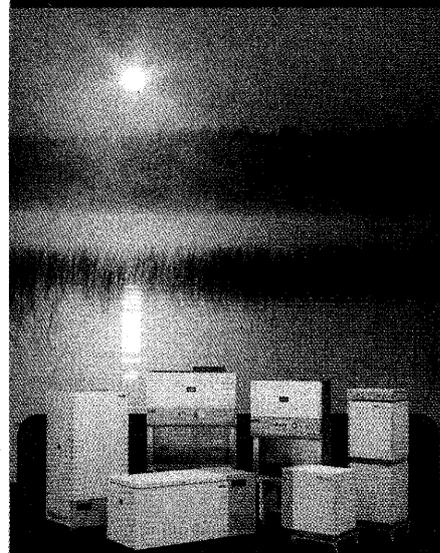
Using inverse modeling of data from the Mars Global Surveyor, Connerney *et al.* (Reports, 30 Apr., p. 794) interpreted linear magnetic features on Mars as reminiscent of patterns associated with sea floor spreading on Earth. In a comment, Harrison argues that the results of the Connerney *et al.* model do not support Earth-type field reversals as the cause of the lineations because the effective inclinations do not fall into groups separated by 180°, as might be expected from a field-reversal mechanism. Connerney *et al.* respond that Harrison's calculations of field directions may be inappropriate in light of the 200-kilometer model resolution, and that the statistical tests proposed by Harrison do not adequately account for the potential complexities of hundreds of millions of years of Mars tectonic history.

Neck Posture of Sauropod Dinosaurs

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/287/5453/547b

Stevens and Parrish (Reports, 30 Apr., p. 798) presented modeling results that suggested that diplodocid sauropod dinosaurs were adapted mainly to ground feeding or low browsing, in contrast to the conventional view of these sauropods as high browsers. Upchurch, while generally concurring with that conclusion, suggests that Stevens and Parrish may have insufficiently considered the role of anterior trunk vertebrae in shaping the feeding envelope, and also questions the reliance of their *Apatosaurus* analysis on a single specimen known to "have suffered severe damage at the base of the neck." Stevens and Parrish acknowledge that anterior trunk flexibility, while beyond the scope of their study, probably contributed to the diplodocids' feeding movements, and provide additional details on how the modeling study dealt with potential for error due to the neck damage in the *Apatosaurus* specimen.

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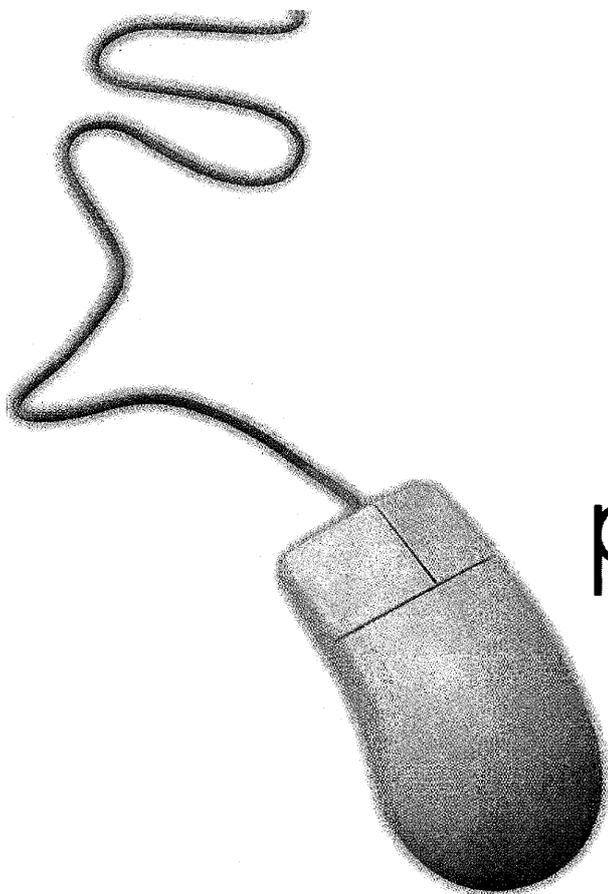
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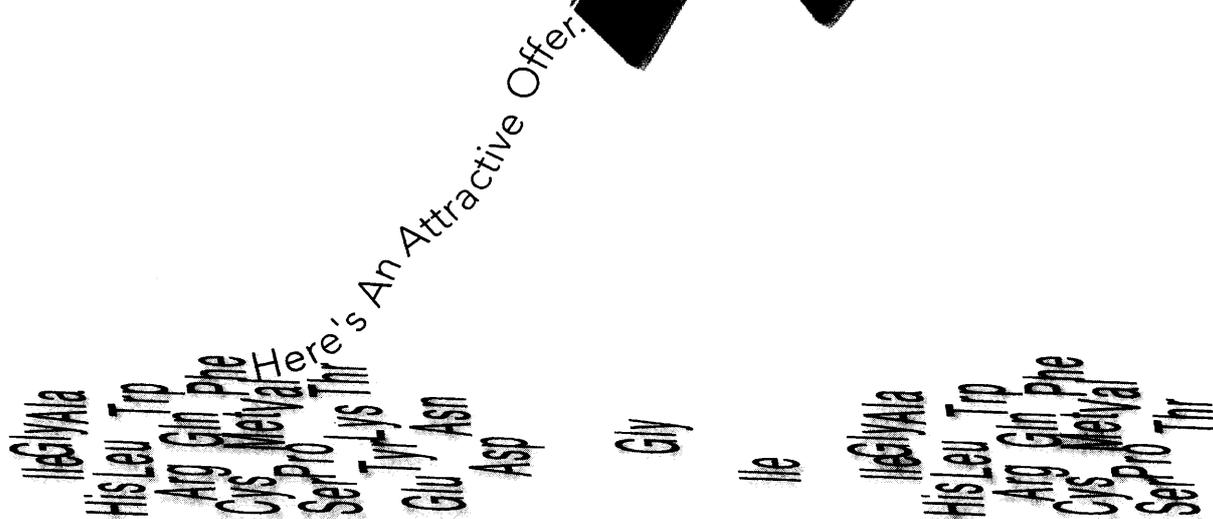


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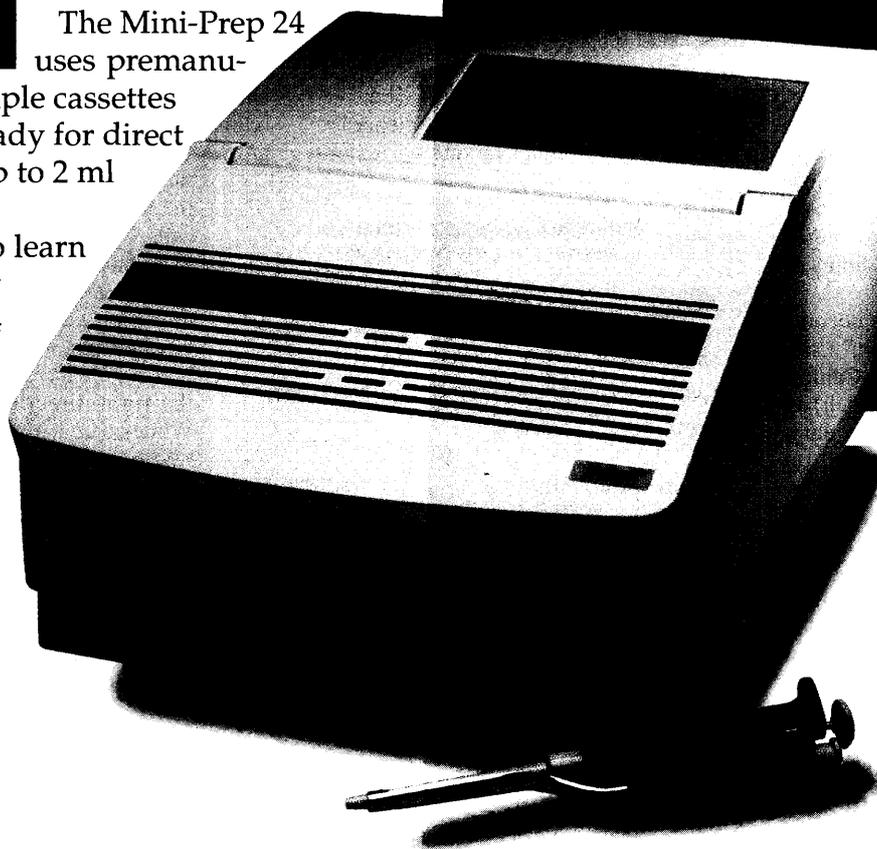
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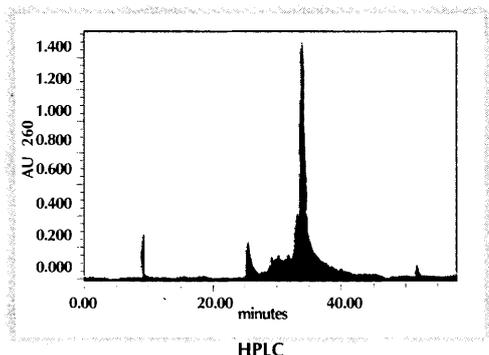


Figure 1



Figure 2

Show Me! After manufacture, FRET probes are initially purified by HPLC, followed by denaturing PAGE. The HPLC chromatogram of a FRET probe is shown in Figure 1. Figure 2 shows an analytical PAGE electrophorogram of the crude FRET probe (lane 1), following HPLC purification (lane 2), and final product after denaturing PAGE purification (lane 3). [Denaturing gel analysis of the HPLC purified FRET probe confirms that not all of the synthesis failure sequences are removed (lane 2)]. The additional purification by PAGE removes those remaining failure sequences that can lead to increased background noise in the PE-ABI 7700 Detection System.

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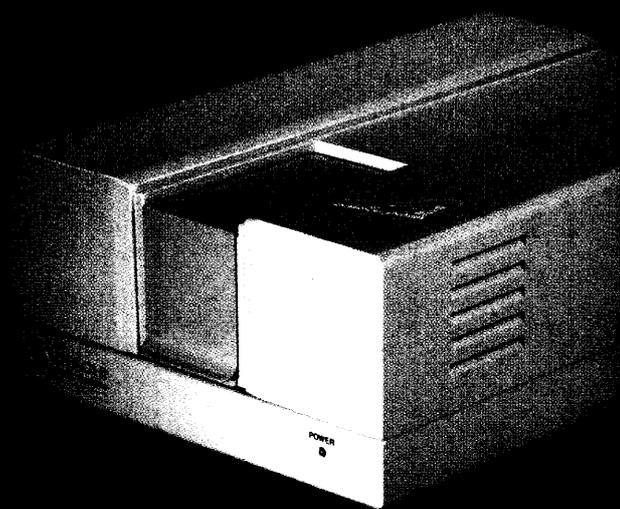
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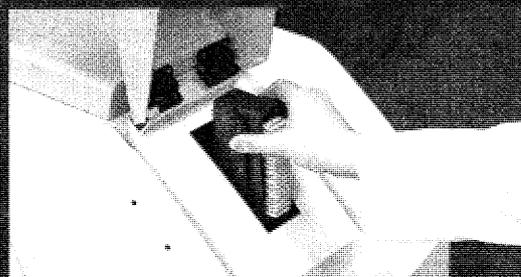
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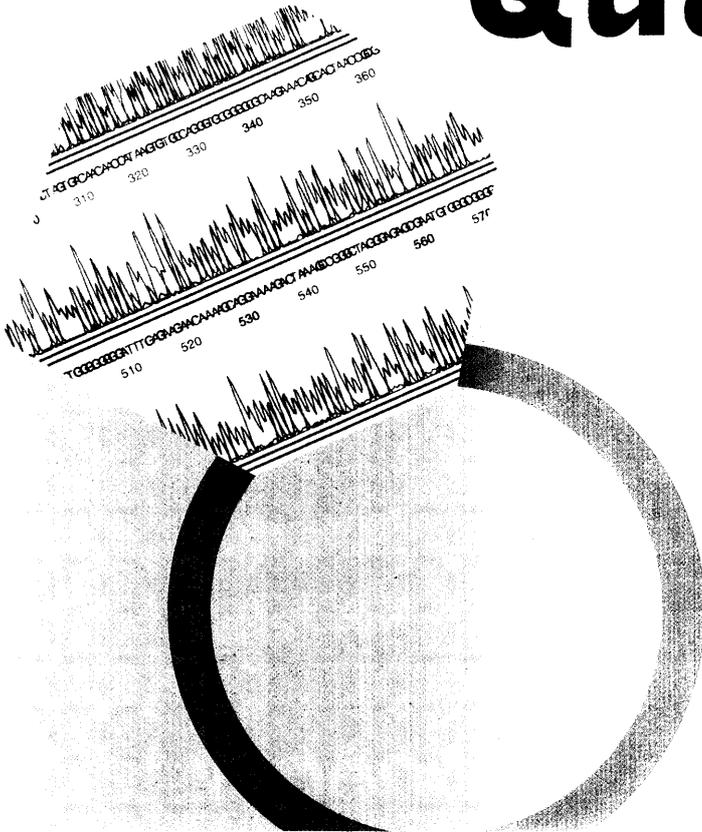
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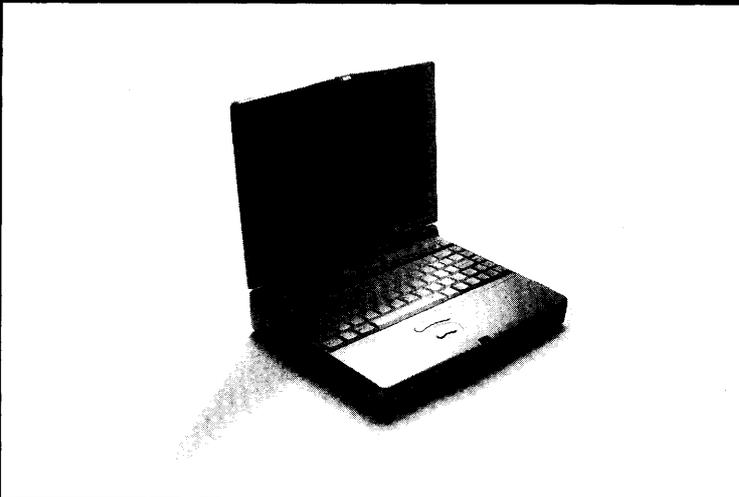


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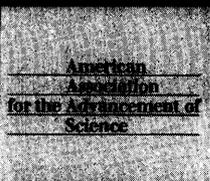
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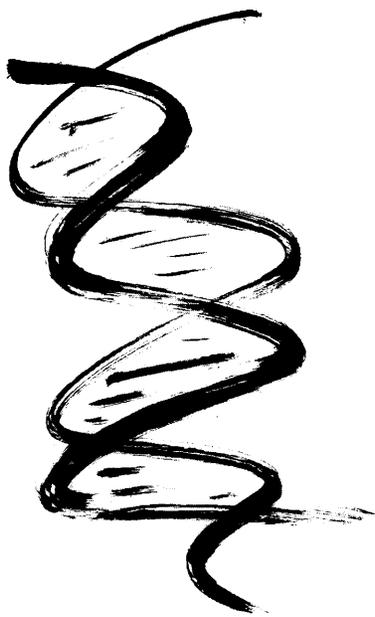
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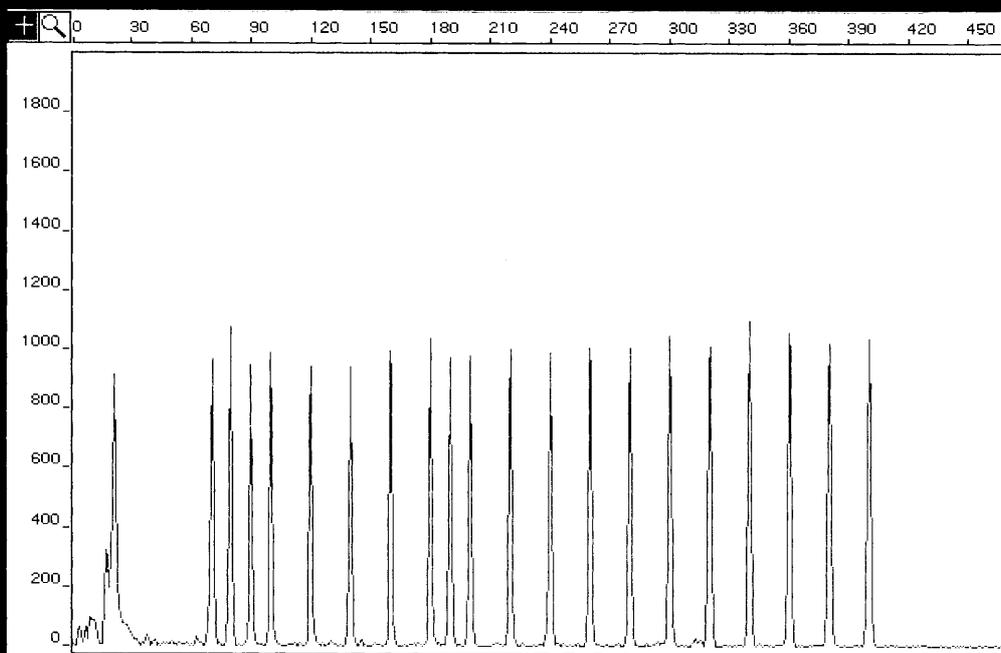


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