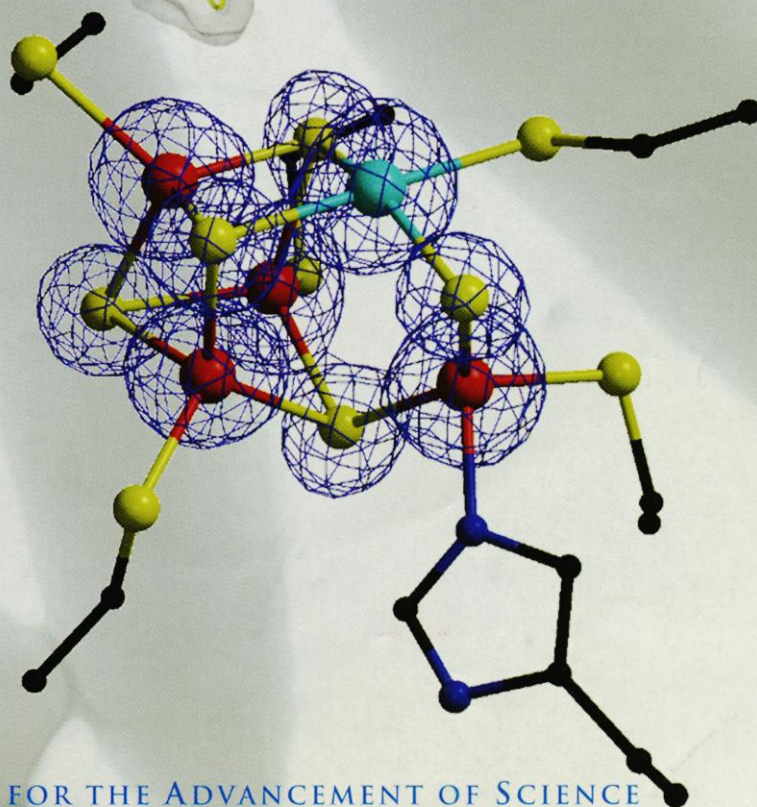
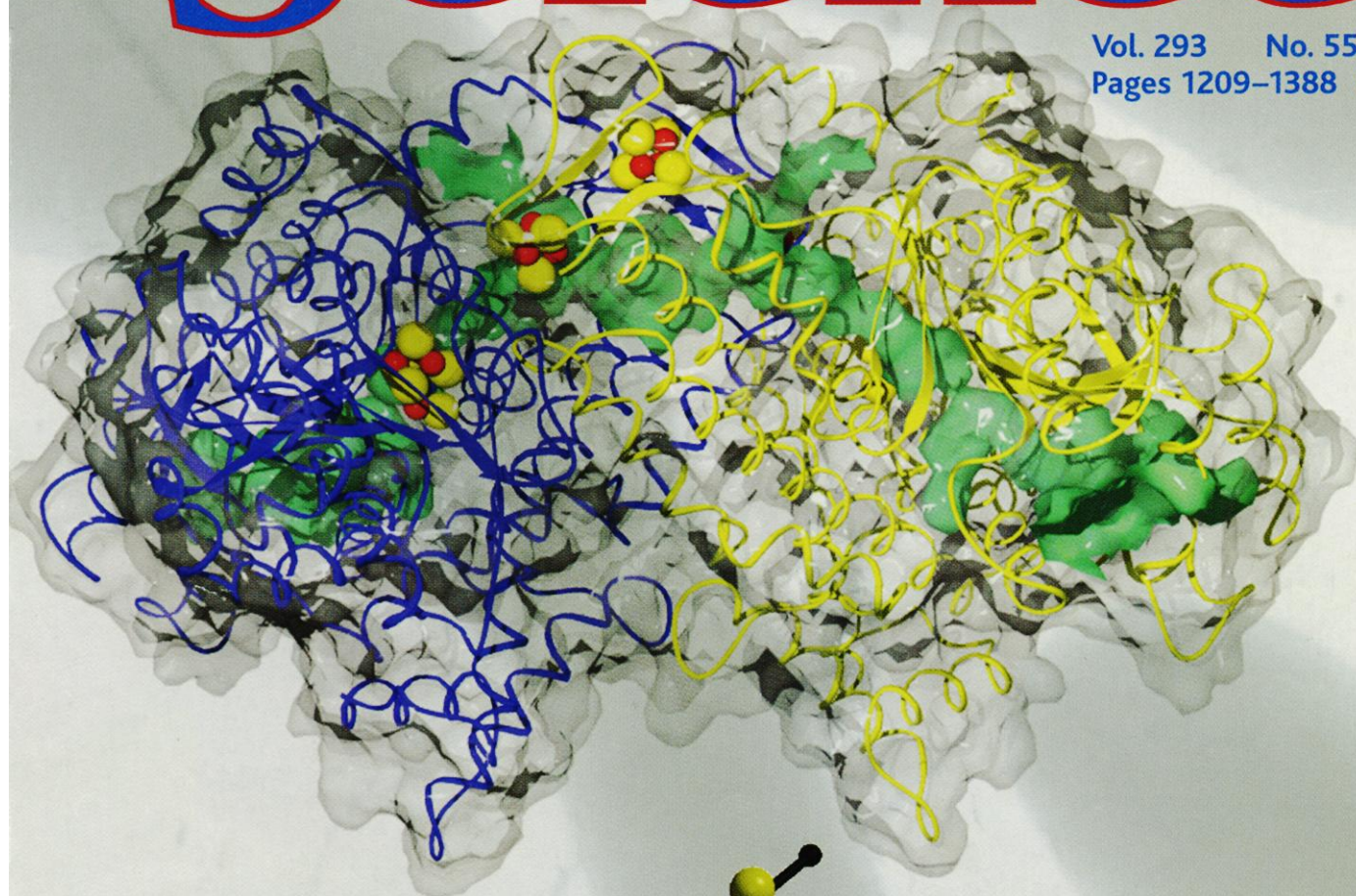


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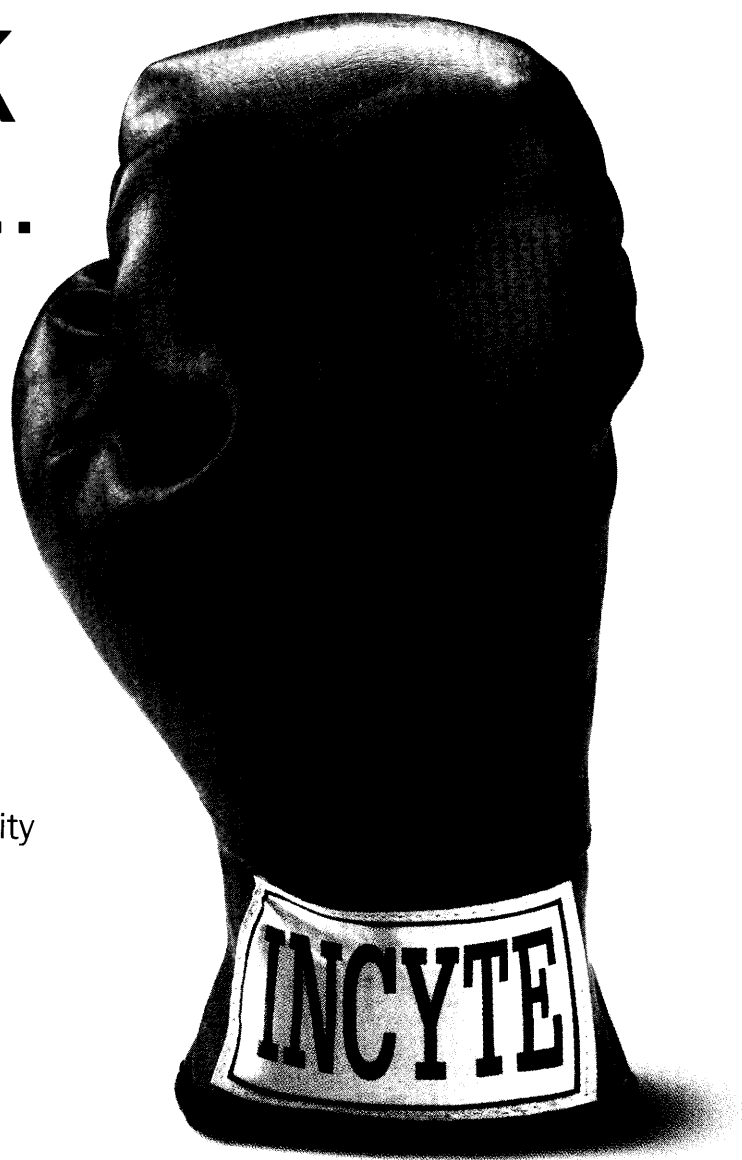
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Science

Volume 293 17 August 2001 Number 5533

1215 **SCIENCE ONLINE**

1217 **THIS WEEK IN SCIENCE**

▼1221
1257 **EDITORIAL**
Donald Kennedy
Going It Alone

1223 **EDITORS' CHOICE**

1227 **NETWATCH**

1230 **CONTACT SCIENCE**

1335 **TECH.SIGHT/NEW PRODUCTS**
Image Analysis

NEWS



1242

Bush balancing act

NEWS OF THE WEEK

- 1234 **BIOMEDICAL POLICY:** NIH Wins an Exemption From HHS Peer-Review Overhaul
- 1234 **ASTRONOMY:** Pull of Gravity Reveals Unseen Galaxy Cluster
- 1235 **ADVANCED COMPUTING:** NSF Launches TeraGrid for Academic Research
- 1237 **PLANT SCIENCE:** How Seedlings See the Light
- 1237 **SCIENCE SCOPE**
- 1238 **ECOLOGY:** Field Test Backs Model for Invader
- 1238 **HUMAN GENOME:** Less Can Be More, U.K. Study Finds
- ▼1239 **EVOLUTIONARY BIOLOGY:** Queens, Not Workers, Rule the Ant Nest
1308
- ▼1241 **ECOLOGY:** Parasitic Wasps Invade Hawaiian Ecosystem
1314



1241

Renegade biocontrol

NEWS FOCUS

- 1242 **BIOMEDICAL POLICY:** Bush Squeezes Between the Lines on Stem Cells
New Chair of Bioethics Panel Wants National Debate on Issues
"I Have Given This Issue a Great Deal of Thought ... and I Have Found Widespread Disagreement"
- 1246 **HUMAN EVOLUTION:** Max Planck's Meeting of the Anthropological Minds
Zoo's New Primate Exhibit to Double as Research Lab
- 1249 **SCIENCE AND COMMERCE:** Chemists for Hire: Have Flask, Will Travel
- 1251 **NATURAL DISASTERS:** Researchers Target Deadly Tsunamis
Modeling a 3600-Year-Old Tsunami Sheds Light on the Minoan Past
- 1255 **RANDOM SAMPLES**

SCIENCE'S COMPASS



- ▼1257 **CLIMATE CHANGE: Hidden Health Benefits of Greenhouse Gas Mitigation** L. Cifuentes, V. H. Borja-Aburto, N. Gouveia, G. Thurston, D. L. Davis
1221

POLICY FORUM

BOOKS ET AL.

- 1260 **HISTORY OF SCIENCE:** *Alfred Russel Wallace A Life* P. Raby, reviewed by G. Nelson
- 1261 **BIOMEDICINE:** *Dr. Folkman's War Angiogenesis and the Struggle to Defeat Cancer*, R. Cooke, reviewed by I. Löwy

PERSPECTIVES

- ▼1263 **CELL BIOLOGY:** A Switch to Release the Motor R. E. Cheney and O. C. Rodriguez
1317
- ▼1264 **ENZYMOLGY:** Nickel to the Fore R. K. Thauer
1281
- ▼1265 **LASER PHYSICS:** Getting to Grips with Light T. Brown, W. Sibbett, E. M. Wright
1286
- ▼1267 **ECOLOGY AND CONSERVATION:** Whose Fish Are They Anyway? J. J. Magnuson, C. Safina, M. P. Sissenwine
1310

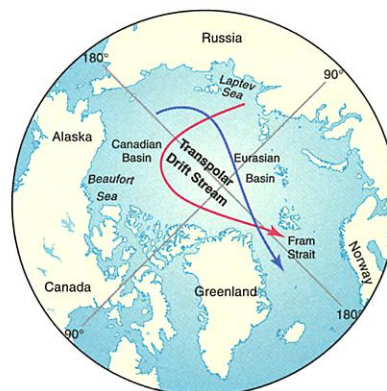
1260

Unconventional explorer

- ▼1269 **OCEANOGRAPHY:** Patterns of Arctic Circulation L. A. Mysak
1301
- ▼1270 **BIOCHEMISTRY:** TRP Ion Channels— Two Proteins in One I. B. Levitan and S. M. Cibulsky
1327
- ▼1271 **NEUROBIOLOGY:** Learning How a Fruit Fly Forgets S. Waddell and W. G. Quinn
1330

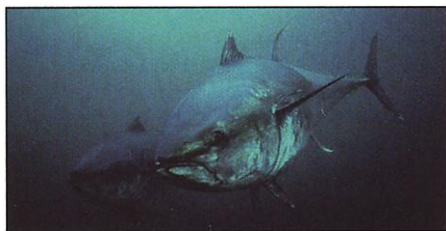
REVIEW

- 1273 **ASTROPHYSICS:** The Morphological Evolution of Galaxies R. G. Abraham and S. van den Bergh



1269

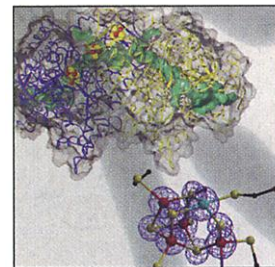
Lead pollution in the Arctic Ocean



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1310

Long-distance tuna



COVER 1281

Crystal structure of reduced carbon monoxide dehydrogenase from the anaerobic hydrogenogenic bacterium *Carboxydotherrnus hydrogeniformans* (electron micrograph in the background), showing the homodimeric enzyme (subunits in blue and yellow). At lower right, the [Ni-4Fe-5S] active-site cluster is shown; the substrate channel is in green, and nickel, iron, and sulfur atoms are in blue, red, and yellow, respectively. [Adapted from Figs. 1, 3, and 4 of Dobbek et al.]

RESEARCH

RESEARCH ARTICLE

- ▼1281
1264 **Crystal Structure of a Carbon Monoxide Dehydrogenase Reveals a [Ni-4Fe-5S] Cluster** H. Dobbek, V. Svetlitchnyi, L. Gremer, R. Huber, O. Meyer

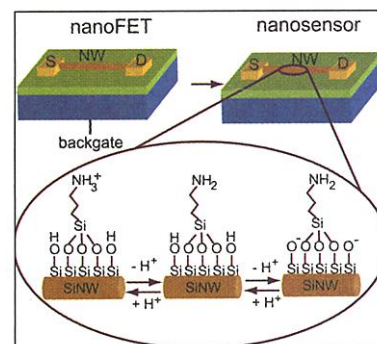
REPORTS

- ▼1286
1265 **Phase-Coherent Optical Pulse Synthesis from Separate Femtosecond Lasers** R. K. Shelton, L.-S. Ma, H. C. Kapteyn, M. M. Murnane, J. L. Hall, J. Ye
- 1289 **Nanowire Nanosensors for Highly Sensitive and Selective Detection of Biological and Chemical Species** Y. Cui, Q. Wei, H. Park, C. M. Lieber
- 1292 **Stable Ordering in Langmuir-Blodgett Films** D. Y. Takamoto, E. Aydil, J. A. Zasadzinski, A. T. Ivanova, D. K. Schwartz, T. Yang, P. S. Cremer
- 1296 **Principles for Measurement of Chemical Exposure Based on Recognition-Driven Anchoring Transitions in Liquid Crystals** R. R. Shah and N. L. Abbott
- 1299 **Ring Closure of Carbon Nanotubes** M. Sano, A. Kamino, J. Okamura, S. Shinkai
- ▼1301
1269 **Atlantic Water Flow Pathways Revealed by Lead Contamination in Arctic Basin Sediments** C. Gobeil, R. W. Macdonald, J. N. Smith, L. Beaudin
- 1304 **Southward Migration of the Intertropical Convergence Zone Through the Holocene** G. H. Haug, K. A. Hughen, D. M. Sigman, L. C. Peterson, U. Röhl
- ▼1308
1239 **Queen Control of Sex Ratio in Fire Ants** L. Passera, S. Aron, E. L. Vargo, L. Keller
- ▼1310
1267 **Migratory Movements, Depth Preferences, and Thermal Biology of Atlantic Bluefin Tuna** B. A. Block, H. Dewar, S. B. Blackwell, T. D. Williams, E. D. Prince, C. J. Farwell, A. Boustany, S. L. H. Teo, A. Seitz, A. Walli, D. Fudge

- ▼1314
1241 **Infiltration of a Hawaiian Community by Introduced Biological Control Agents** M. L. Henneman and J. Memmott
- ▼1317
1263 **Cell Cycle Regulation of Myosin-V by Calcium/Calmodulin-Dependent Protein Kinase II** R. L. Karcher, J. T. Roland, F. Zappacosta, M. J. Huddleston, R. S. Annan, S. A. Carr, V. I. Gelfand
- 1320 **Cohesin Cleavage by Separase Required for Anaphase and Cytokinesis in Human Cells** S. Hauf, I. C. Waizenegger, J.-M. Peters
- 1323 **Vascular Abnormalities and Deregulation of VEGF in Lkb1-Deficient Mice** A. Ylikorkala, D. J. Rossi, N. Korsisaari, K. Luukko, K. Alitalo, M. Henkemeyer, T. P. Mäkelä
- ▼1327
1270 **Immunocyte Ca²⁺ Influx System Mediated by LTRPC2** Y. Sano, K. Inamura, A. Miyake, S. Mochizuki, H. Yokoi, H. Matsushime, K. Furuichi
- ▼1330
1271 **The Role of *Drosophila* Mushroom Body Signaling in Olfactory Memory** S. E. McGuire, P. T. Le, R. L. Davis

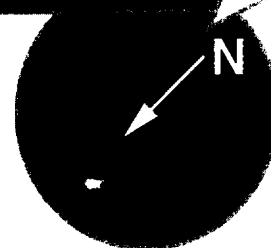
1289

Silicon-nanowire sensors



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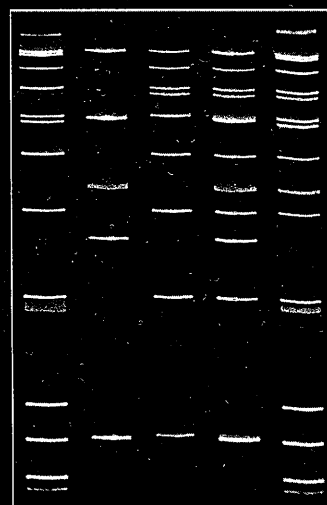
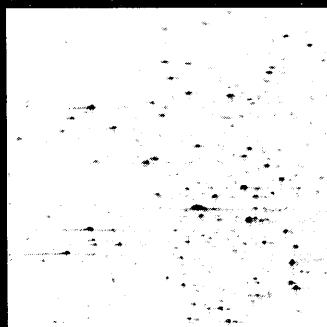
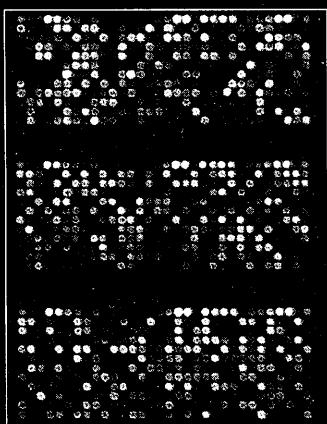
Signaling through protein degradation



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Direct Interaction of *Arabidopsis* Cryptochromes with COP1 in Mediation of Photomorphogenic Development H. Wang, L.-G. Ma, J.-M. Li, H.-Y. Zhao, X. W. Deng

Cryptochrome signaling response to blue light moves downstream to the proteasome.

An Essential Role for BAFF in the Normal Development of B Cells Through a BCMA-Independent Pathway B. Schiemann *et al.*

Mice lacking the TNF-like molecule, B cell activating factor (BAFF), cannot produce B cells.

BAFF-R, a Novel TNF Receptor That Specifically Interacts with BAFF J. S. Thompson *et al.*

A specific receptor for BAFF is found to play a key role in B cell development.

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Perspective: Ras Isoform-Specific Signaling—Location, Location, Location A. Wolfman
How COOH-terminal modifications of the Ras isoforms govern their location.

Perspective: PODs in the Nuclear Spot—Enigmas in the Magician's Pot M. Hatta and A. Fukamizu

A nuclear subcompartment involved in regulating apoptosis and gene expression.

science's next wave

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Canada: Business Plan Competition Sparks New and Great Inventions L. McCarney

Last week, the Innovations Foundation announced its second business plan competition for high tech and biotech business ideas. And for the first time, the competition is open to entrepreneurs outside the University of Toronto.

UK: Enough Is Enough—Plan Your Lab Escape Strategy P. H. Dee

Starting your career means finishing your Ph.D., and that means drawing your lab work to a close so you can get on with writing up. But unless you make a plan, you may find it difficult to get that "last" experiment done.

US: Your Relationship with Human Resources—Part 2: Aceing the HR Interview D. Jensen

In a follow-up to last month's Tooling Up column, Jensen dissects the methods and meanings behind the unique questions you should expect from HR.

US: Improving Research Writing Skills—The Postdoc Editors Club J. Gray, M. Mata, T. Sweitzer

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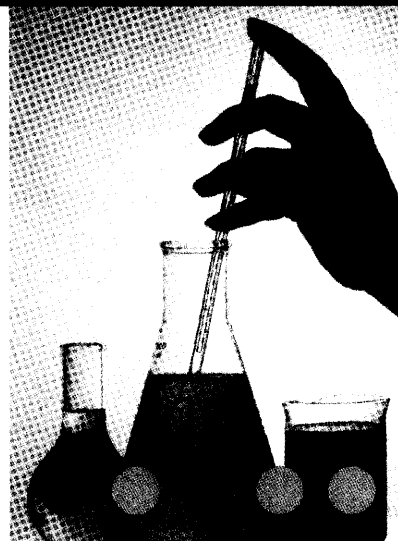
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THIS WEEK IN Science

edited by Phil Szuromi

Carbon Nanotubes Close the Loop

A method for forming large rings from single-walled carbon nanotubes (SWNT) is described by Sano *et al.* (p. 1299). They solubilized SWNTs through a cutting technique and then lightly etched them to generate a distribution of tubes that are oxygenated at both ends. Nanotubes of intermediate length could form closed loops that, after a subsequent chemical reaction and annealing, were stable when treated with ring-opening reactants or subjected to high temperatures.

Langmuir-Blodgett Films Come to Order

The formation of Langmuir-Blodgett films, in which ordered monolayers of amphiphilic molecules at a surface are transferred to solid support, is one of the oldest nanoassembly methods. However, as films build up, defects introduced by reordering transitions limit the usefulness of these films. Takamoto *et al.* (p. 1292) report that by working at higher solution pH (8.5 instead of the typical 7), films of cadmium arachidate that are harder to draw actually form nearly defect-free films. The high-pH films, which on the aqueous phase form a "pseudo-herringbone" structure, convert to a hexagonal structure after deposition without the further reorganization that disrupts film layering, as is the case with pH-7 films.

COmbustion

Both aerobic and anaerobic microbes possess an enzyme, carbon monoxide dehydrogenase (CODH), that converts CO into CO₂ and that is important for forward and reverse reactions that cycle carbon globally between CO₂ and acetate. In some cases, the CO₂ can be used as a carbon source through incorporation into acetyl-coenzyme A. Dobbek *et al.* (p. 1281; see the cover and the Perspective by Thauer) describe the crystal structure at 1.6-angstrom resolution of CODH from *Carboxydotherrmus hydrogenoformans*. This enzyme utilizes an unusual [Ni-4Fe-5S] cluster in which CO binds to the Ni, thus rendering it susceptible to attack from a hydroxyl moiety bound to a neighboring Fe.

The Queen Gets Her Way

Sex ratio studies in ants provide one of the better tests of parent-offspring conflict and kin-selection theories. Theory predicts that workers prefer a more female-biased sex ratio than do queens, and the prevailing view is that workers win this conflict. Passera *et al.* (p. 1308; see the news story by Pennisi), however, show that sex ratio can sometimes be under queen control. Queens of the fire ant *Solenopsis invicta* can force workers to produce males by limiting the number of female eggs. This finding provides an ex-

1286 Toward a Light-Wave Generator

Mixing light waves of different frequencies is a routine technique for synthesizing waveforms of arbitrary shape and spectral composition. For applications in coherent quantum control, ultrafast optical pulses over a range of wavelengths may be required. Shelton *et al.* (p. 1286; see the Perspective by Brown *et al.*), building on recent advances involving phase-locking of femtosecond optical pulses, generation of a comb of optical frequencies, and precision measurement of optical frequencies, now show that two waveforms can be coherently stitched together from separate femtosecond lasers to form a coherent pulse train.

planation for sex investment ratios departing from the worker optimum in this and many other ant species.

Sensing with Nanoscale Surfaces

The use of nanoscale surfaces provides a new twist for designing sensors with semiconductors and with liquid crystals. The adsorption of charged molecules or ions on the surfaces of semiconductors can lead to changes in their surface conductivity that can be exploited in chemical sensing. Cui *et al.* (p. 1289) increased the sensitivity of this effect by using semiconducting nanotubes instead of planar surfaces. Functionalized boron-doped silicon nanotubes were used to detect changes in pH and the concentrations of an antibody and of Ca²⁺ in real time.

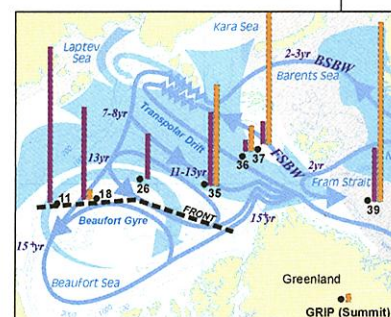
Competitive binding to molecular receptors on a surface has been used to create a colorimetric sensor based on liquid crystal ordering with part per billion sensitivity to organic molecules. Shah and Abbott (p. 1296) patterned glass surfaces that have nanometer-scale corrugation with self-assembled monolayers of alkyl thiols bearing molecular receptors (for example, carboxylic acid groups for targeting amines). This layer was covered with a film of a liquid crystal that binds weakly to the molecular receptor. This weak-induced ordering of the liquid crystal, which can be observed with polarized light, is disrupted by the much stronger binding of the desired analyte. Such systems could be used as wearable sensors for monitoring exposure limits.

A Lead into Arctic Circulation

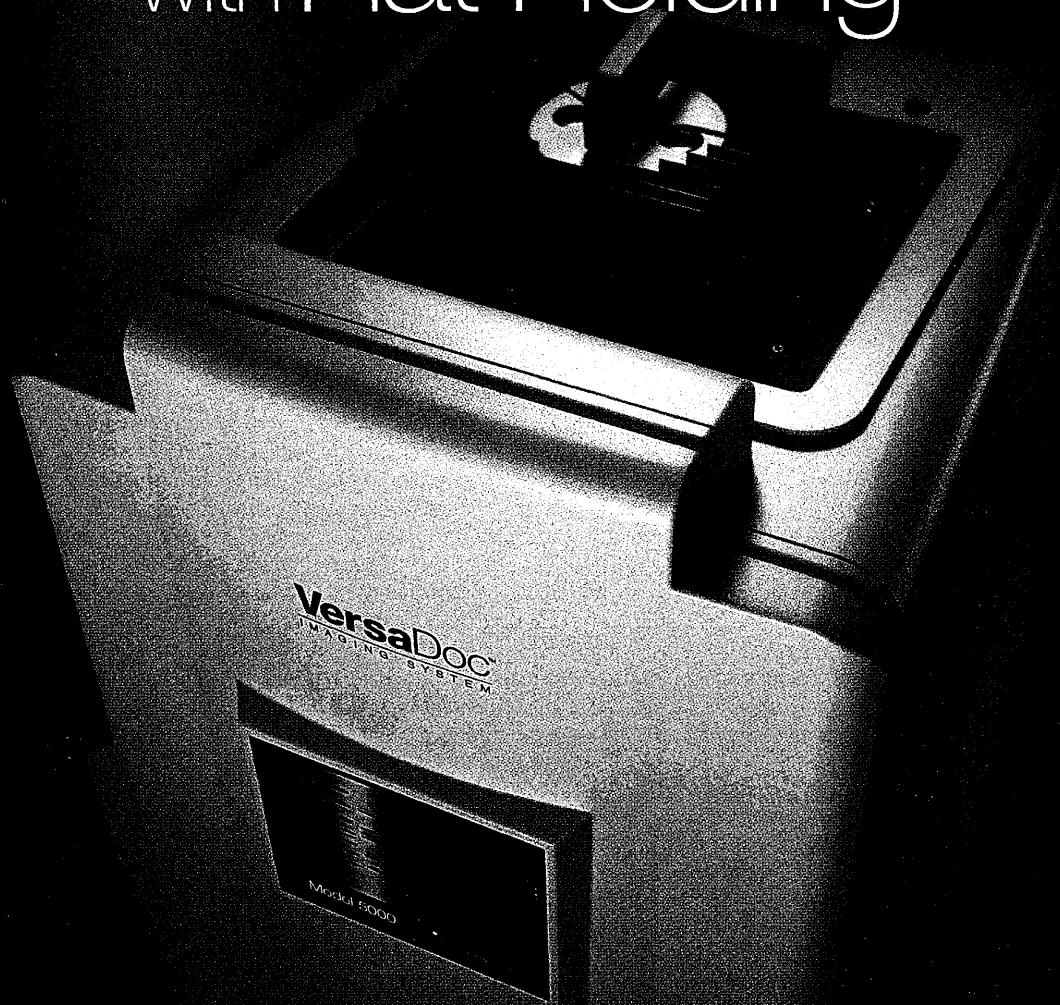
Knowledge of the variability of water circulation in the Arctic Ocean during the past century is relatively limited, as is the understanding of how many anthropogenic pollutants are transported there. Using lead as a tracer, Gobeil *et al.* (p. 1301; see the Perspective by Mysak) paint a picture of Arctic boundary currents that clearly identifies their connection with the Atlantic Ocean and shows that the ocean, not the atmosphere, dominates the transport of anthropogenic lead to Arctic waters. The distribution of contaminant lead and its isotopic composition allows the authors to reconstruct Arctic Ocean current stability during the past 50 years.

Tailing Tuna

Sustainable management of the Atlantic bluefin tuna, one of the most valuable commercial fish, has been hampered by inade-



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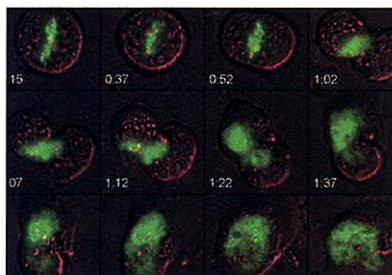
quate knowledge of the bluefin's migratory movements, spawning grounds, and population mixing. To record these movements, Block *et al.* (p. 1310; see the Perspective by Magnuson *et al.*) used electronic archival data tags programmed to remain on fish for up to 1 year before floating to the surface so that the accumulated data can be downloaded via satellite. Tuna resident in the West Atlantic return to breeding grounds in the Gulf of Mexico and in the Mediterranean, and suggest that more rigorous protection will be necessary in these spawning grounds if the bluefin is to be conserved.

Myosin-V Regulation

Myosin-V is a microtubule-based motor responsible for promoting organelle movements around the cell, particularly the movement of melanophores around melanocytes. During mitosis, the activity of myosin-V is down-regulated, probably by phosphorylation, as the microtubule machinery is co-opted into spindle assembly and membrane traffic shuts down. Karcher *et al.* (p. 1317; see the Perspective by Cheney and Rodriguez) describe the precise phosphorylation site that is present in the organelle-binding carboxyl terminal of the protein. The authors suggest that such phosphorylation to abrogate cargo binding may be used more generally.

The Tie that Binds

During cell division, sister chromatids are held together by complex of proteins called cohesin. In yeast, proteolysis of the cohesin subunit known as Scc1p is thought to be the event that actually releases the chromatids, which then migrate to the daughter cells in anaphase. However, in vertebrate cells, most of the cohesin dissociates from the chromosomes before metaphase. Hauf *et al.* (p. 1320) now show that the small amount of cohesin that remains on chromosomes and is lost at the start of anaphase must be cleaved to allow separation of the sister chromatids. They made mutants of the human cohesin subunit SCC1 that could not be cleaved. In human cell lines that express physiological amounts of the modified SCC1, chromatid separation and subsequent cytokinesis were disrupted. The authors note that defects in this mechanism could contribute to genomic instability in tumor cells.



Current Trends in Calcium Currents

Identification and characterization of new calcium channels that may function to control calcium-dependent signaling continues at a rapid pace. Sano *et al.* (p. 1327; see the Perspective by Levitan) describe the human LTRP2 channel, a member of the transient receptor potential (TRP) family that is abundantly expressed in the blood. The channel contains a motif in its cytoplasmic tail that is associated with nucleotide hydrolase activity. In cells transfected with LTRP2, conductance of the channel was directly activated by adenosine diphosphate ribose (ADPR), or β -nicotinamide adenine dinucleotide (β -NAD). In immunocyte cell lines, they observed a similar inward calcium current when cells were exposed to ADPR or β -NAD. In a Perspective, Levitan and Cibulsky summarize other recent work that has characterized a different TRP-family member and in which different regulatory properties and ADPR pyrophosphatase activity are ascribed to LTRP2.

A Write-Only Memory

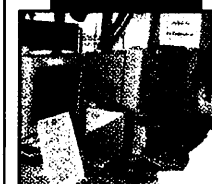
From our subjective perspective, the process of memory appears seamless and easy, until trauma or the aging process interferes. McGuire *et al.* (p. 1330; see the Perspective by Wadell and Quinn) have developed a controlled version of such interference in *Drosophila* by conditionally expressing the gene *shibire*, which encodes a dynamin guanosine triphosphatase, in the mushroom bodies of the fly's brain. This protein plays an essential role in synaptic vesicle recycling. By using changes in temperature to turn off expression of this gene, mushroom-body function could be turned on and off during different phases of an odor-recognition task. Mushroom bodies are necessary for memory retrieval but not for acquisition or consolidation. Thus, the fly can learn and store the information, but cannot later remember it. ✕

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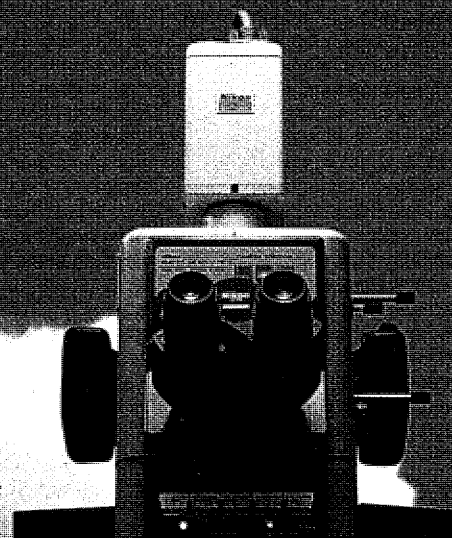
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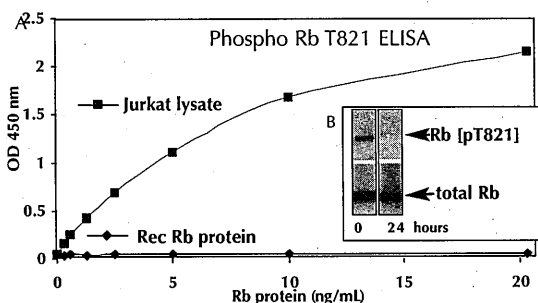
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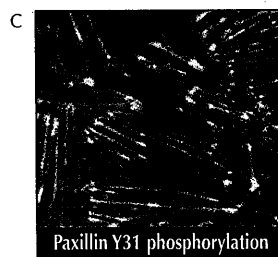
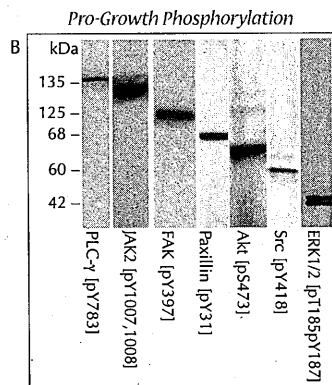
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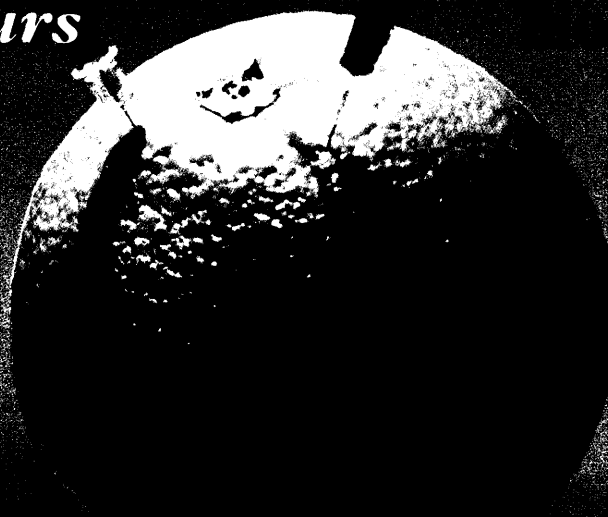
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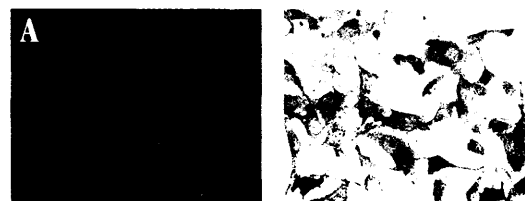


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1. Zelphati, O *et al.* (2001) Paper in press: *J. Biol. Chem.*
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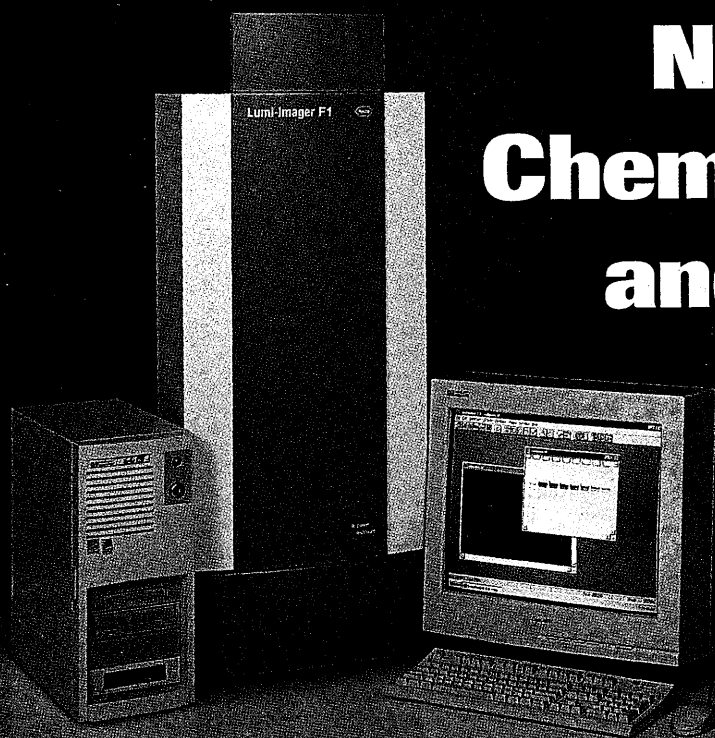
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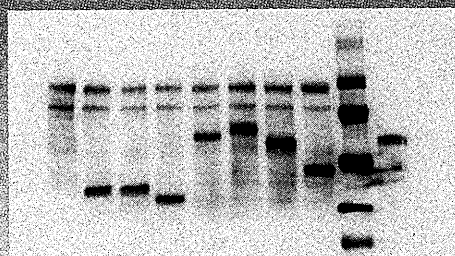
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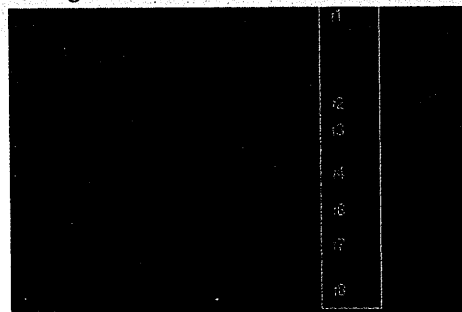


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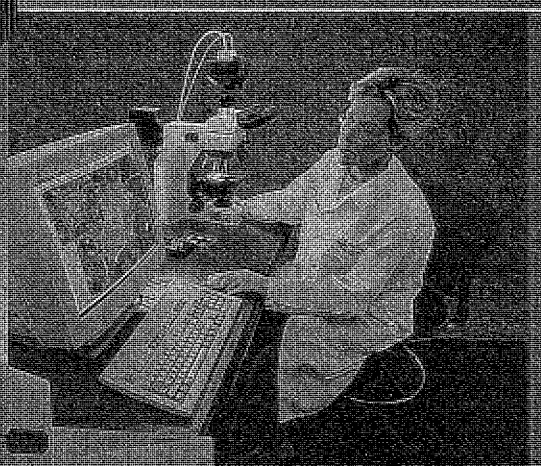
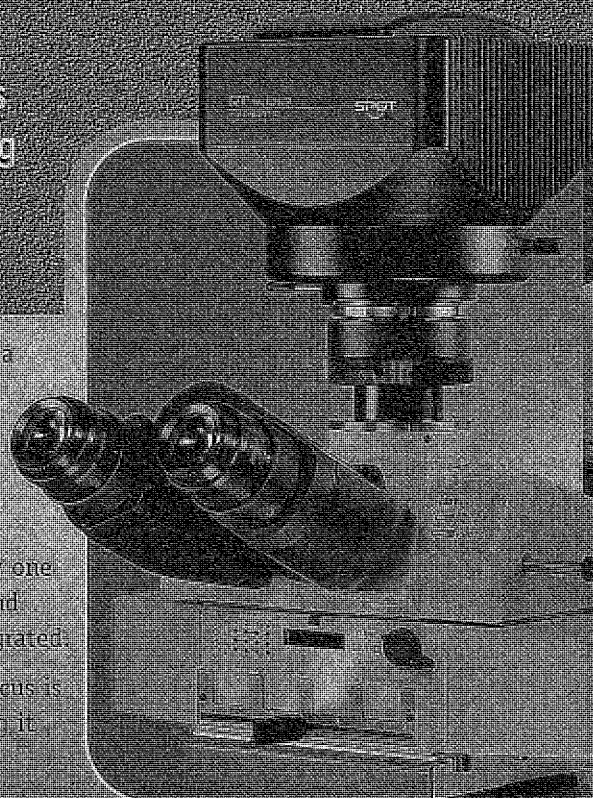
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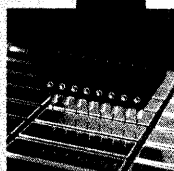
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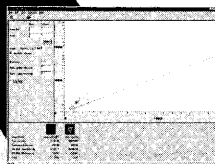
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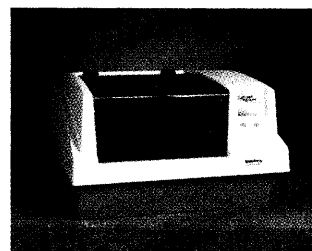
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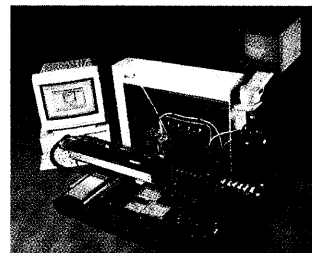


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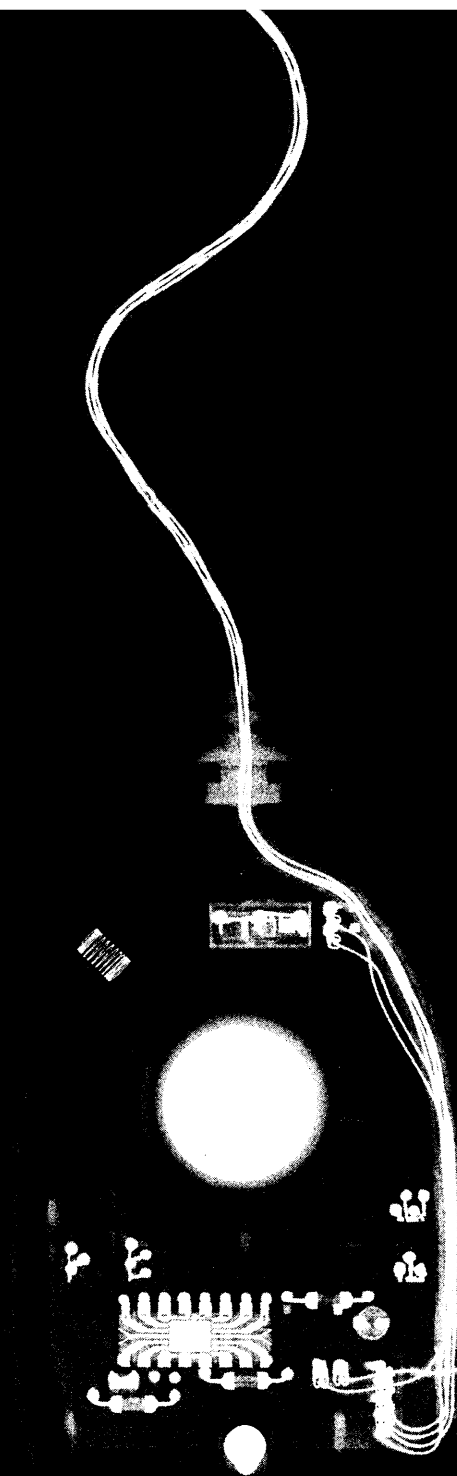
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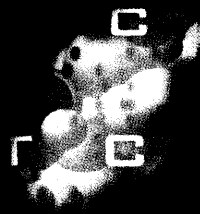
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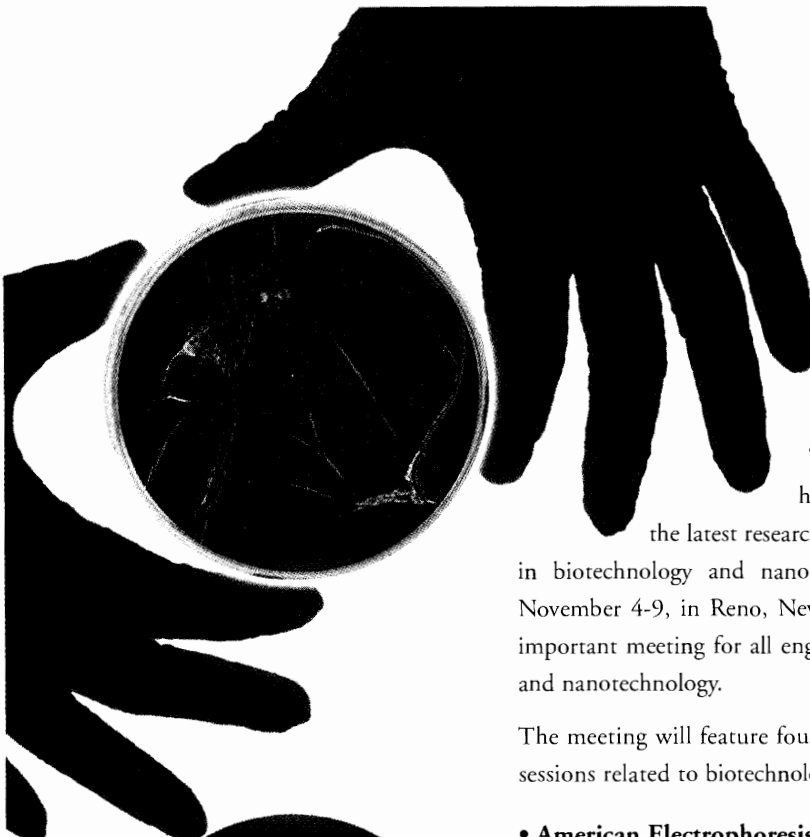
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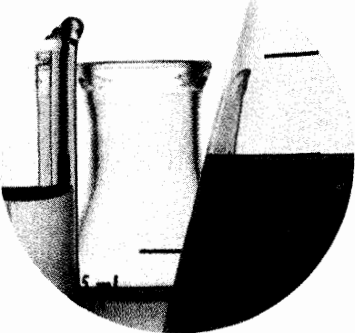
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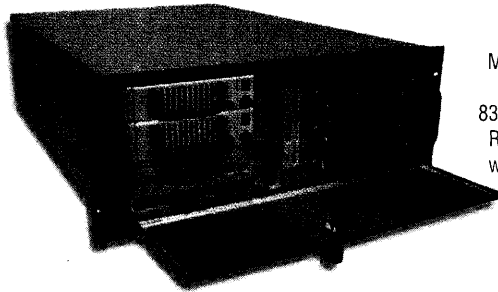


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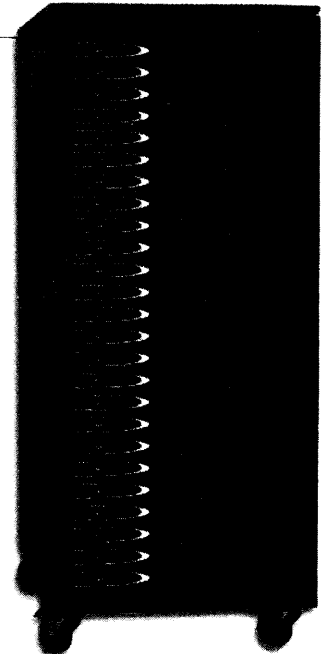
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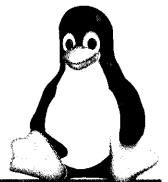
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