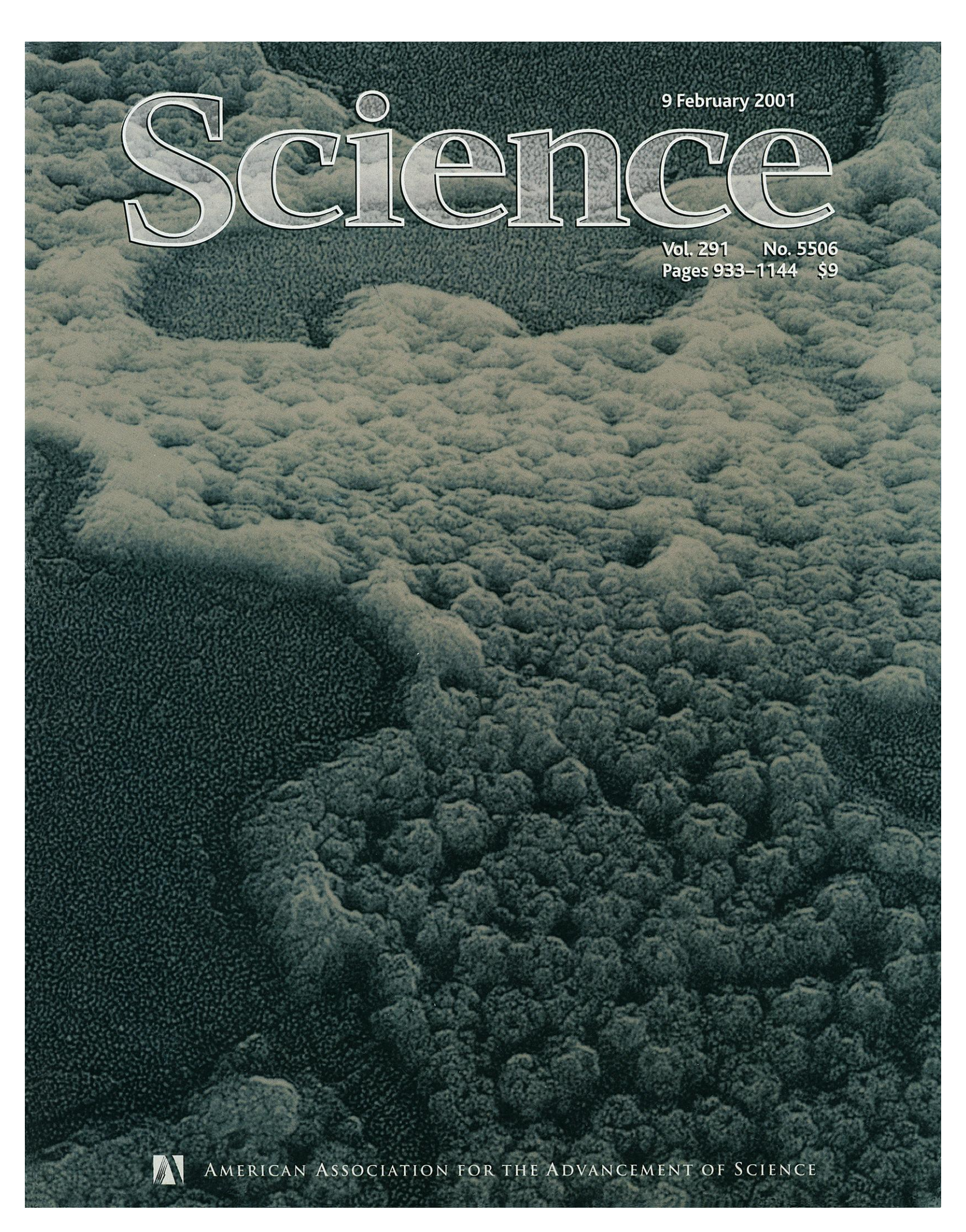


A high-magnification scanning electron micrograph (SEM) showing a complex, textured surface. The surface is composed of numerous small, rounded, and interconnected features, creating a bumpy, almost cellular appearance. The lighting is directional, coming from the upper left, which highlights the peaks and ridges of the texture while casting deep shadows in the valleys and crevices. The overall color palette is monochromatic, ranging from dark greys to light greys, emphasizing the three-dimensional topography of the material.

Science

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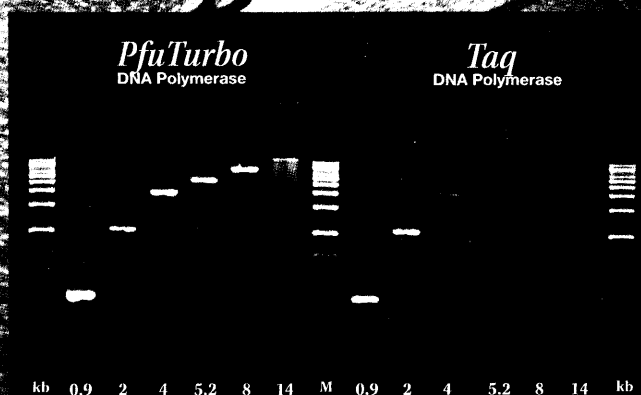


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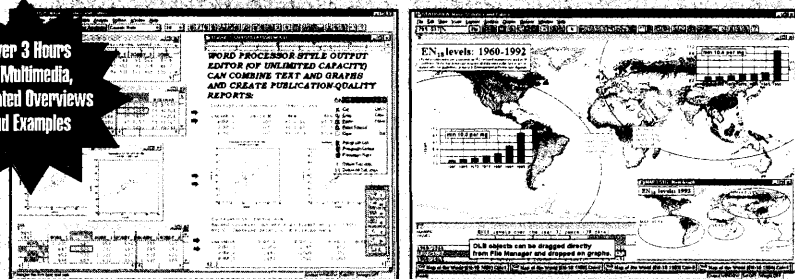
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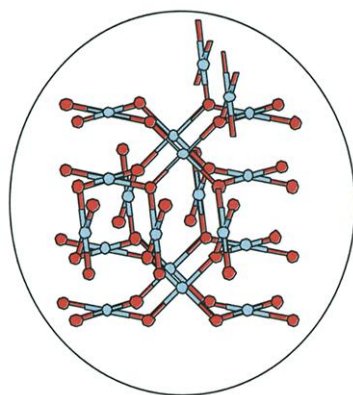
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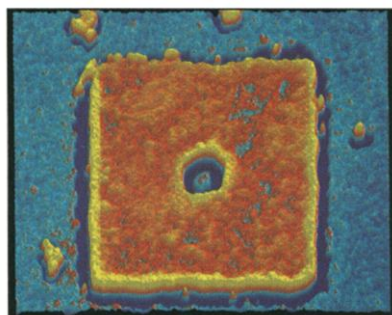
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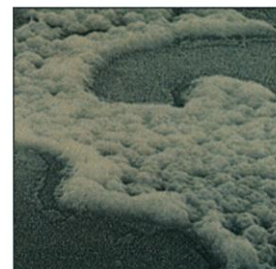
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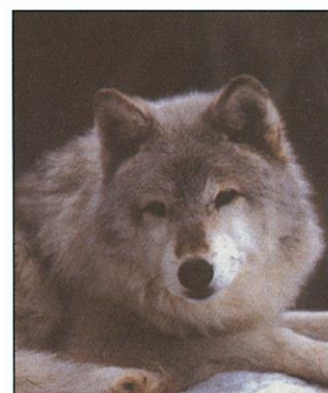
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COVER 1051

Vesicles that form on the inner surface of cellular membranes capture and internalize extracellular substances for import into eukaryotic cells. This electron micrograph shows these vesicular buds in vitro (bud diameter, ~77 nanometers), coated with the protein clathrin. The adaptor proteins, AP180 and AP2, nucleate the formation of these invaginated buds on lipid monolayers containing phosphatidylinositol(4,5)bisphosphate. This specimen was visualized by rotary platinum shadowing. [Image: M. K. Higgins]



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How prey adjust to reintroduced predators

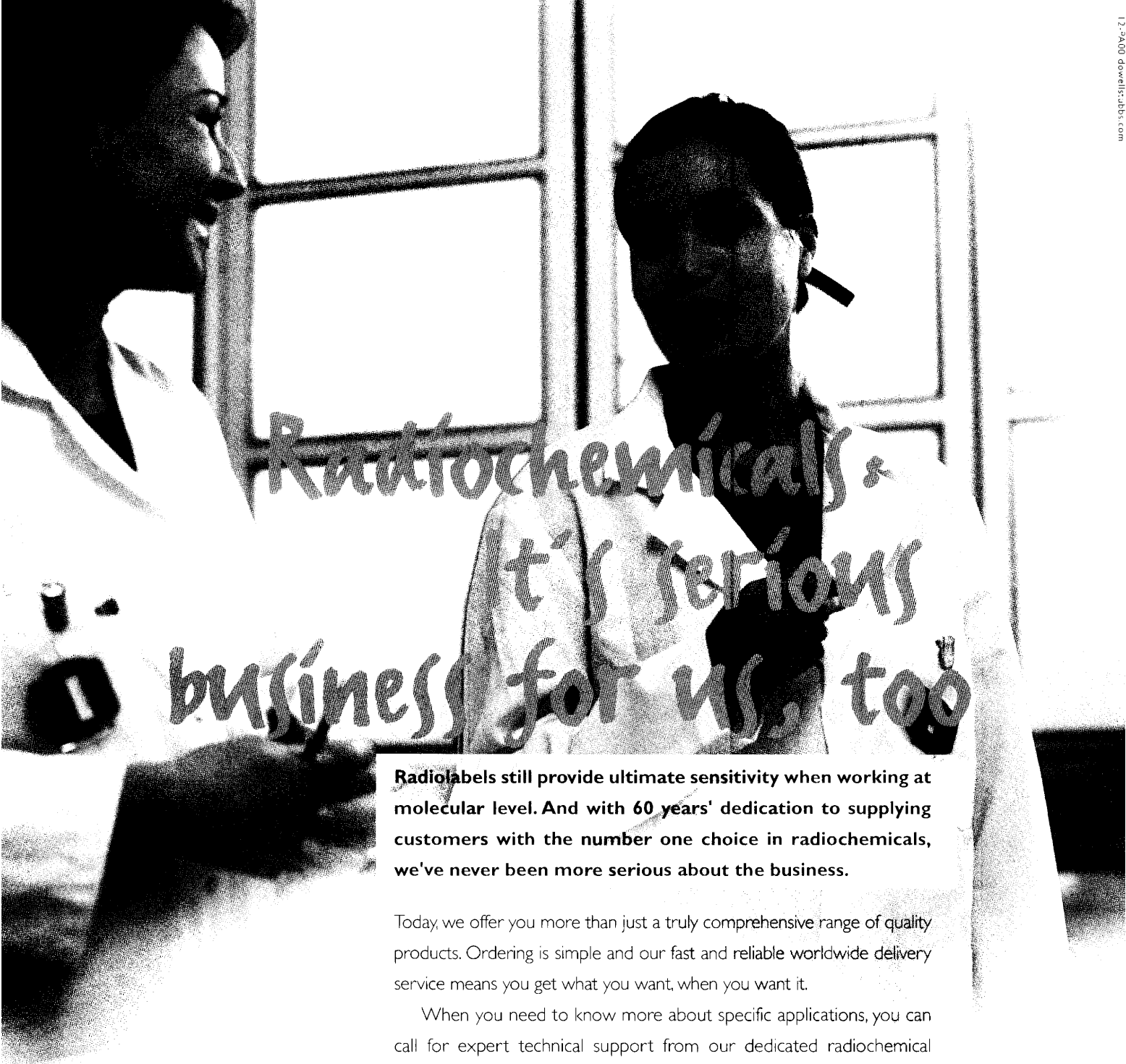
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Tracking air pollution above the Indian Ocean



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Quantum Mechanical Actuation of Microelectromechanical Systems by the Casimir Force H. B. Chan, V. A. Aksyuk, R. N. Kleiman, D. J. Bishop, F. Capasso

A demonstration of mechanical actuation by quantum mechanical fluctuations.

Presynaptic Kainate Receptor Mediation of Frequency Facilitation at Hippocampal Mossy Fiber Synapses D. Schmitz, J. Mellor, R. A. Nicoll

Activation of a presynaptic receptor augments, rather than inhibits, neurotransmitter release, a mechanism that may account for some unusual characteristics of mossy fiber synapses.

Hierarchical Organization of Guidance Receptors: Silencing of Netrin Attraction by Slit Through a Robo/DCC Receptor Complex E. Stein and M. Tessier-Lavigne

As growing axons respond to guidance molecules along their path, orderly progress is ensured by new guidance molecules "silencing" the responses to previous ones.

TECHNICAL COMMENTS

Dam Breaching and Chinook Salmon Recovery

Kareiva *et al.* (Reports, 3 Nov. 2000, p. 977) used a population model to argue that the proposed removal of dams from the Snake River, a controversial undertaking, may not be sufficient to halt the decline toward extinction of chinook salmon. Dambacher *et al.* comment that if alternative estimates of one of the model parameters, first-year survival, that are consistent with published data are factored into the Kareiva *et al.* model, the model implies that dam breaching could indeed reverse the decline of salmon stocks. Thus, Dambacher *et al.* conclude, "dam breaching remains a viable recovery option for chinook salmon." Kareiva *et al.* respond that the first-year survival rate they used "falls within the range of documented values" for the specific stocks and period of interest, and that the adjustments applied to other variables by Dambacher *et al.* oversimplify the details of the Kareiva *et al.* model.

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/291/5506/939a

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Perspective: Arrestins as Signaling Molecules Involved in Apoptotic Pathways—A Real Eye Opener W. E. Miller and R. J. Lefkowitz

Signaling cascades initiated by internalized G protein-coupled receptor complexes.

Q&A: Lipid Rafts—Real or Artifact? Moderator: M. Edidin

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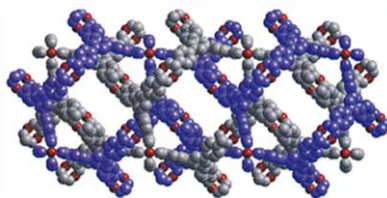
edited by Phil Szuromi

A Different Spin on Memories

An approach that could reduce the size and increase the speed of magnetic memories is to use magnetization precession, in which a smaller magnetic field is used to store information in the form of rotations of the magnetization direction. Weber *et al.* (p. 1015; see the Perspective by Ralph) used spin-injection into a thin ferromagnetic film from a polarized semiconductor cathode to induce the magnetization precession. Their results indicate that spin-injection could be a viable route to smaller and faster magnetic memories.

Interweaving Porous Metal-Organic Frameworks

Although most microporous materials are based on inorganic materials, organic building blocks tied together with metal complexes can also form microporous materials, but often the pore sizes are small and exchange of adsorbed species is difficult. Chen *et al.* (p. 1021; see the Perspective by Férey) report that the condensation of a copper "paddle wheel" complex with a triangular linker unit results in a large-pore material (pore diameters of about 16 angstroms) in which two three-dimensional networks are interwoven. The high thermal stability (up to 250°C) and surface area suggest possible applications in gas sorption and catalysis.



Virtual Switching of Fluid Flow

Fluids tend to hold to surfaces that they wet—in lithographic printing, ink wets only part of the printing plate and leaves the rest dry. Zhao *et al.* (p. 1023) patterned fluid microchannels in glass with self-assembled monolayers that repel aqueous solvents. At low fluid pressures, fluid stays within the uncoated regions through these "virtual walls." However, as pressure is increased, surface tension is overcome and the fluid is driven into nonwetting regions. Such channels could be used to route fluids through junctions and for increasing gas-liquid mixing in microchannel networks.

Particularly Destructive

Stratospheric denitrification—the removal of HNO_3 by particle sedimentation—is an important process in the ozone cycle because certain nitrogen-containing compounds that would react with ozone-destroying Cl radicals become sequestered. Widespread deni-

1013 Quantum Protection of Ions

The encoding and manipulation of information on the quantum scale may offer the opportunity to solve complex problems otherwise intractable to classical computation methods. However, the interaction of the quantum system with its environment results in a loss of information—a process known as decoherence. Earlier theoretical work indicated the existence of protected environments in which careful manipulation of the quantum bits could reduce the effect of decoherence; these environments are called decoherence-free subspaces (DFS). Kielpinski *et al.* (p. 1013) demonstrate the ability to place an entangled pair of ions held in an ion trap into such a DFS, extending the lifetime of the quantum state by an order of magnitude. X

trification in the Arctic has been documented repeatedly, but how this occurs has been unclear. Fahey *et al.* (p. 1026; see the news story by Kerr) have now observed a class of large particles (10 to 20 micrometers in diameter) containing HNO_3 that form during winter in the Arctic stratosphere and that are widely distributed—over at least 1800 kilometers in horizontal extent.

Scaling Down Nanostructures

Lithography is a flexible method for creating microstructures but it can be plagued by resolution problems for dimensions below about 100 nanometers. Hatzor and Weiss (p. 1019) used the gaps between features in nanostructures created by electron-beam lithography as templates for creating still-smaller features. They self-assemble successive multilayers of mercaptoalkanoic acids and copper ions on the nanostructures and thus create a smaller gap between existing metal structures. Deposition of additional metal and subsequent liftoff of the metal-organic layer can create nanowires 20 nanometers in width and 1 micrometer in length, as well as small rings or dots within hollow structures.

Haze over the Indian Ocean

The atmosphere above the Indian Ocean is influenced by air masses from Africa and South and Southeast Asia, but little is known about how pollution from these regions affects air quality over the ocean. Lelieveld *et al.* (p. 1031) report results from INDOEX, an international field campaign that took measurements in 1999 of the long-range transport of air pollution over the Indian Ocean. Very high pollution levels were observed over the entire Northern Indian Ocean that can be traced to South and Southeast Asia. The nature of the pollution is indicative of widespread biofuel use and agricultural burning.

Changing Rules of Engagement

When a predator enters a landscape and encounters prey that have no previous experience of that predator, the prey can suffer heavily. Berger *et al.* (p. 1036; see the Perspective by Gittleman and Gompper), in a study of wolves and bears preying on moose in North America and Scandinavia, show that most of the damage is inflicted along the front of the advancing predator population. However, naïve prey quickly become accustomed to the new predators and change their behavior to avoid them. These findings bear on current human reintroductions of predators and on how fauna may have responded to advancing human populations during the Pleistocene.

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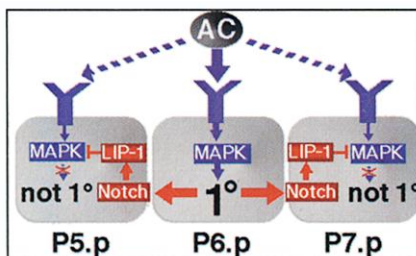
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A Family of Larks

Familial advanced sleep phase syndrome is inherited autosomally. These individuals have unusual sleep cycles and wake up abnormally early each morning. In one such family, Toh *et al.* (p. 1040; see news story by Chicurel, 12 Jan.) report that this characteristic is due to a single nucleotide mutation in the human *Period2* gene; this blocks phosphorylation by casein kinase 1 ϵ . In a satisfying parallel with studies in animals, a deficit in such phosphorylation shortens the animal's circadian period, due to altered function of *per* in the molecular feedback loops that make up the circadian clock. This striking effect of a genetic polymorphism on human behavior paves the way to understanding the basis of human variation in daily rhythms. **X**

Sealing Your Neighbor's Fate

During vulval development in *Caenorhabditis elegans*, a signal arises from an anchor cell that activates the mitogen-activated protein (MAP) kinase signaling pathway to specify the cell fate of three vulval precursor cells, with the primary fate effected in the P6.p cell and secondary fate in the adjacent P5.p and P7.p cells. Berset *et al.* (p. 1055) show that the different fates are produced in adjacent cells through the action of two antagonistic signaling pathways. Upon activating the MAP kinase signaling pathway, the primary fate of P6.p is induced. A lateral signal moves out from P6.p that up-regulates NOTCH in P5.p and P7.p. NOTCH turns on the MAP kinase phosphatase gene *lip-1*. LIP-1, in turn, blocks MAP kinase activity in P5.p and P7.p and allows the secondary cell fate to develop.



Kinase and Channel in One Package

An ion channel that contains its own functional protein kinase domain has been cloned and characterized by Runnels *et al.* (p. 1043) The channel, called TRP-PLIK, is most closely related to melastatin, a channel protein associated with progression of melanocytic tumors. TRP-PLIK also appears to interact with the key signaling enzyme phospholipase C- β_1 . Mutagenesis studies of the kinase domain and the dependence of channel conductance on intracellular adenosine triphosphate both indicate that the kinase activity of the channel regulates channel function. This channel likely links signaling from the cell membrane to the control of proliferation or of other calcium-dependent processes within the cell. **X**

Coordinating Entry

A variety of proteins that help promote endocytosis, the inward budding of vesicles from the plasma membrane, possess an amino-terminal domain called ENTH. Two reports show that binding of proteins to the membrane lipid phosphatidylinositol-4,5-bisphosphate (PIP₂) plays a key role in endocytosis (see the Perspective by Gillooly and Stenmark). Itoh *et al.* (p. 1047) show that the ENTH domain interacts with PIP₂. Cells expressing a mutant of epsin that could no longer bind PIP₂ exhibited a block in clathrin-mediated endocytosis. In addition, Ford *et al.* (p. 1051; see the cover) show that PIP₂ binds to another ENTH domain-containing protein, CALM, and helps clathrin bind to the membrane.

Dead But Not Inert

Water and nutrients move passively upward through plants from roots to leaves via xylem vessels, dead cells that have hitherto been thought to function as mere pipes. Zwieniecki *et al.* (p. 1059; see the news story by Brown, 26 Jan.) describe an active mechanism for regulating long-distance flow through the xylem. They show that the resistance to flow in these rigid tubes can be changed rapidly (within seconds) and reversibly as a function of the concentration of trace ions flowing through the conduits. This finding breaks the paradigm of xylem as inert pipes and changes our understanding of water transport in plants. **X**

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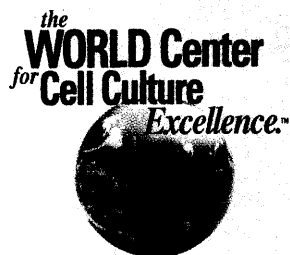
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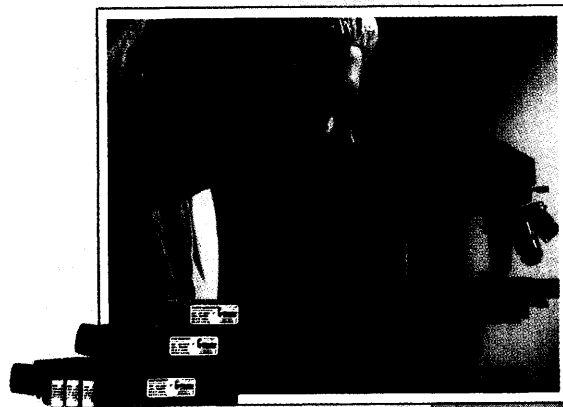


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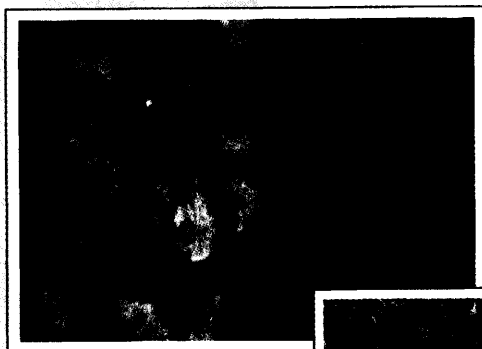


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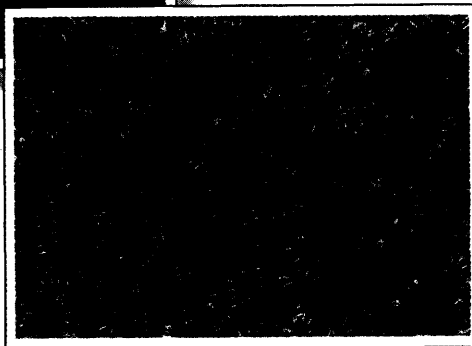
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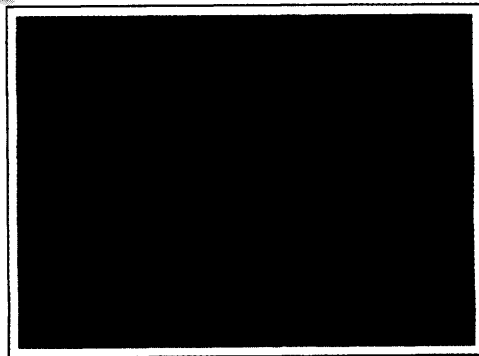
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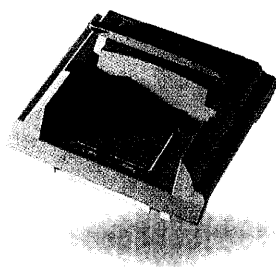
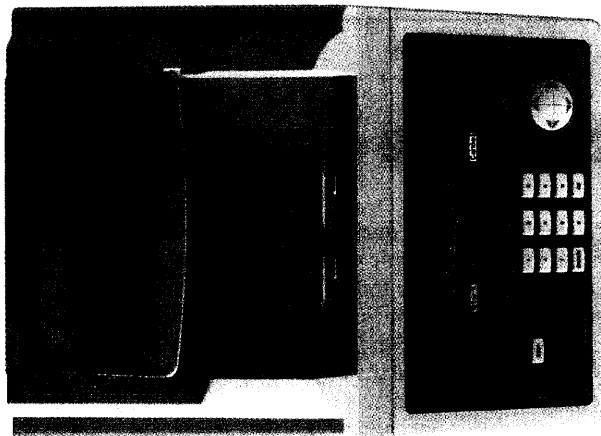
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Endothelial Cell Types

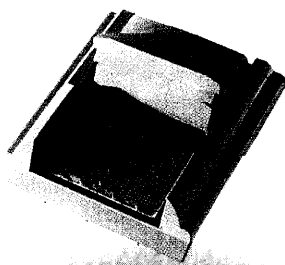
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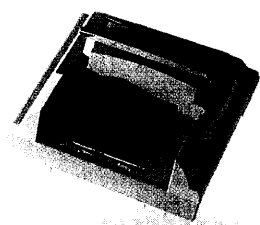




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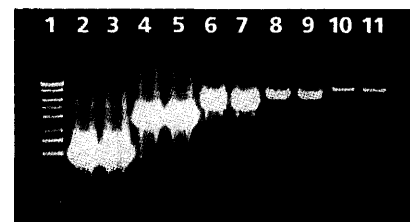
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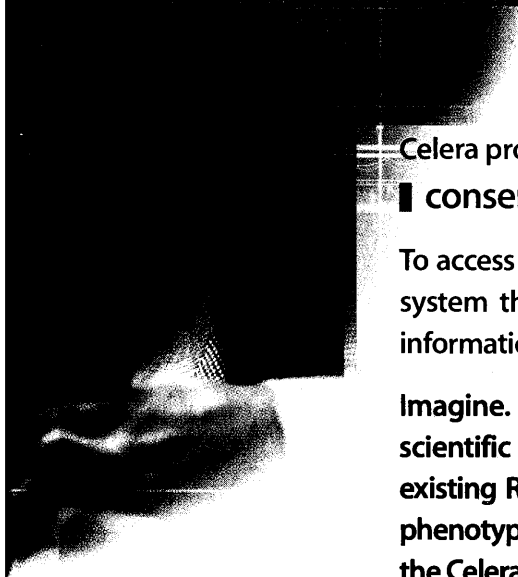
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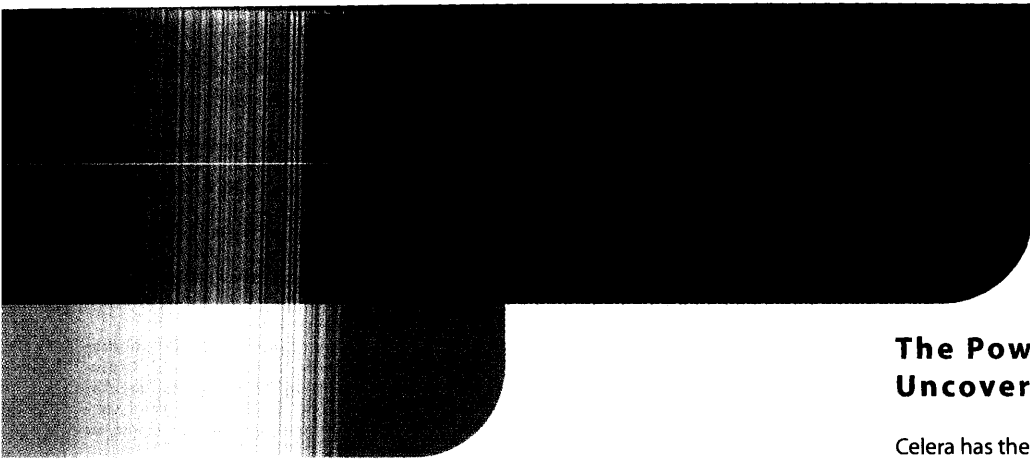
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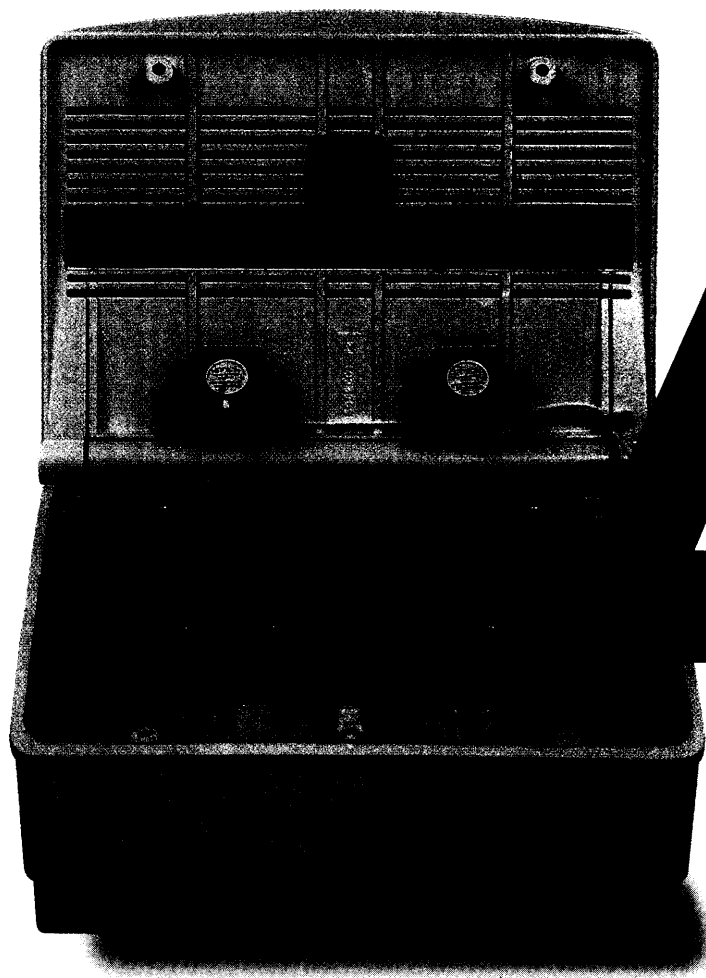
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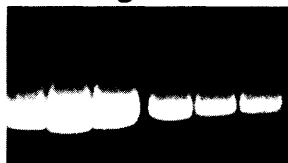
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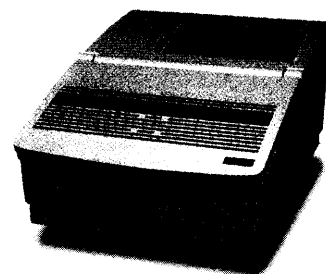
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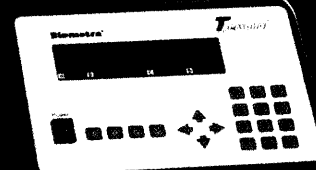
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Picture: Model of a *Taq* DNA Polymerase with a DNA strand. Image made with Molsoft-ICM.

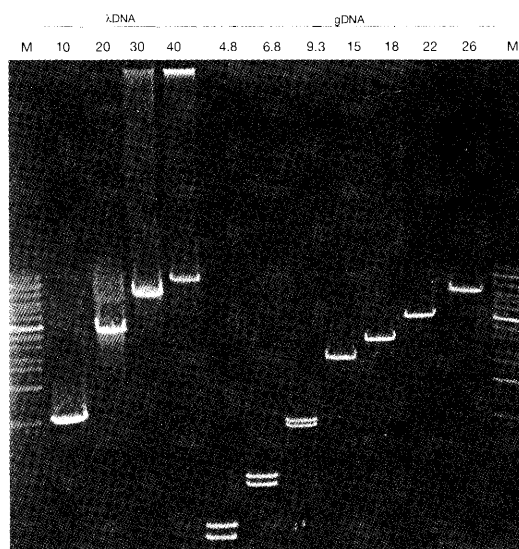
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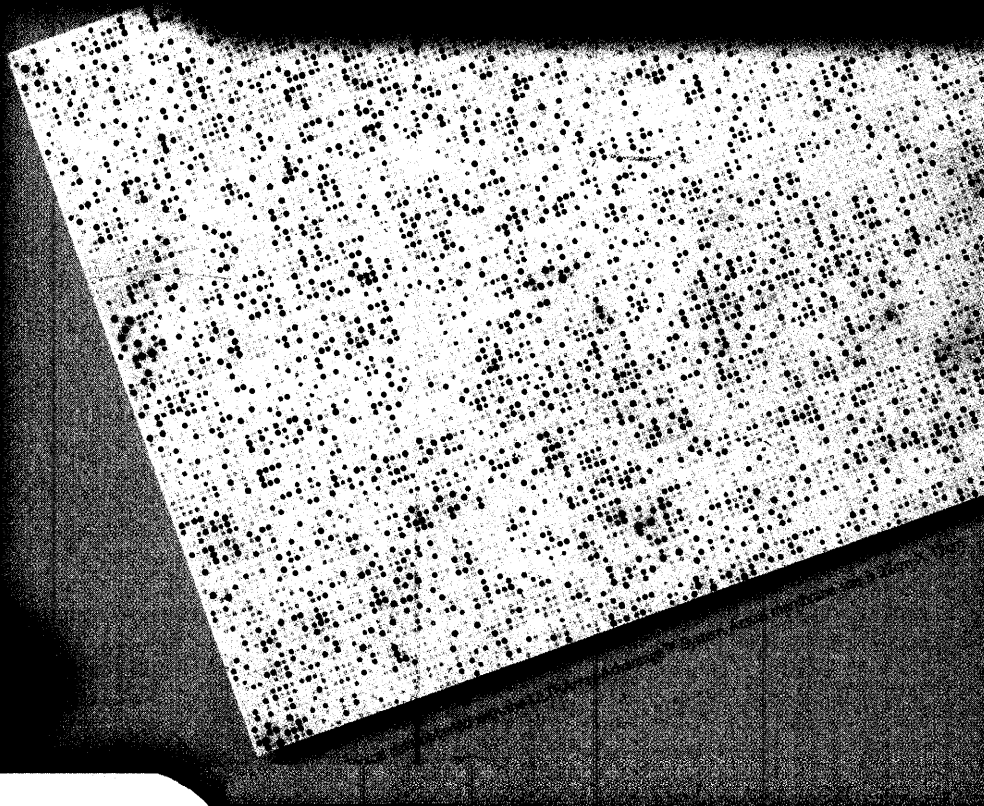
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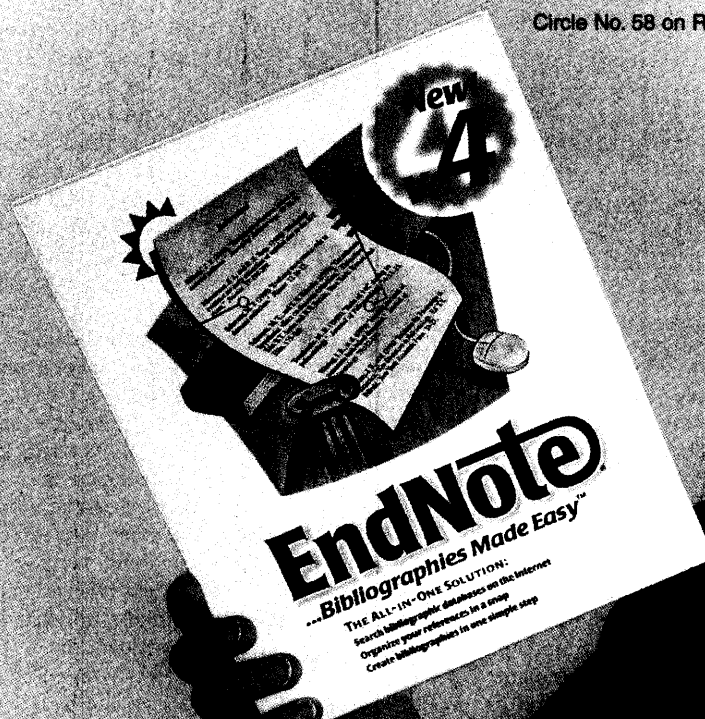
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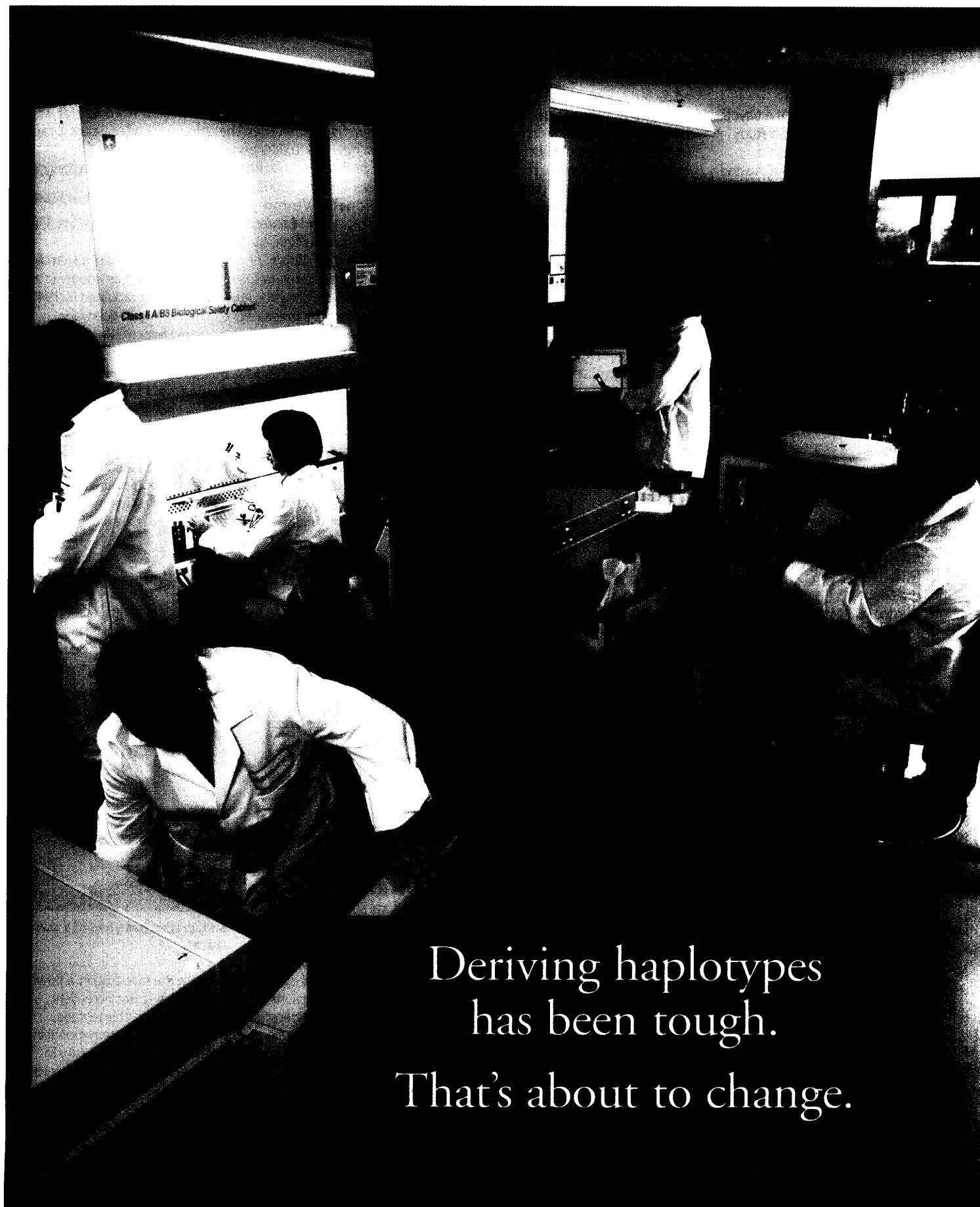
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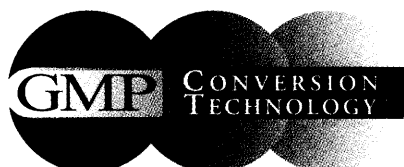
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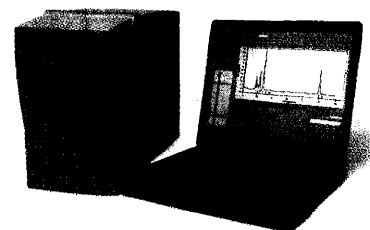
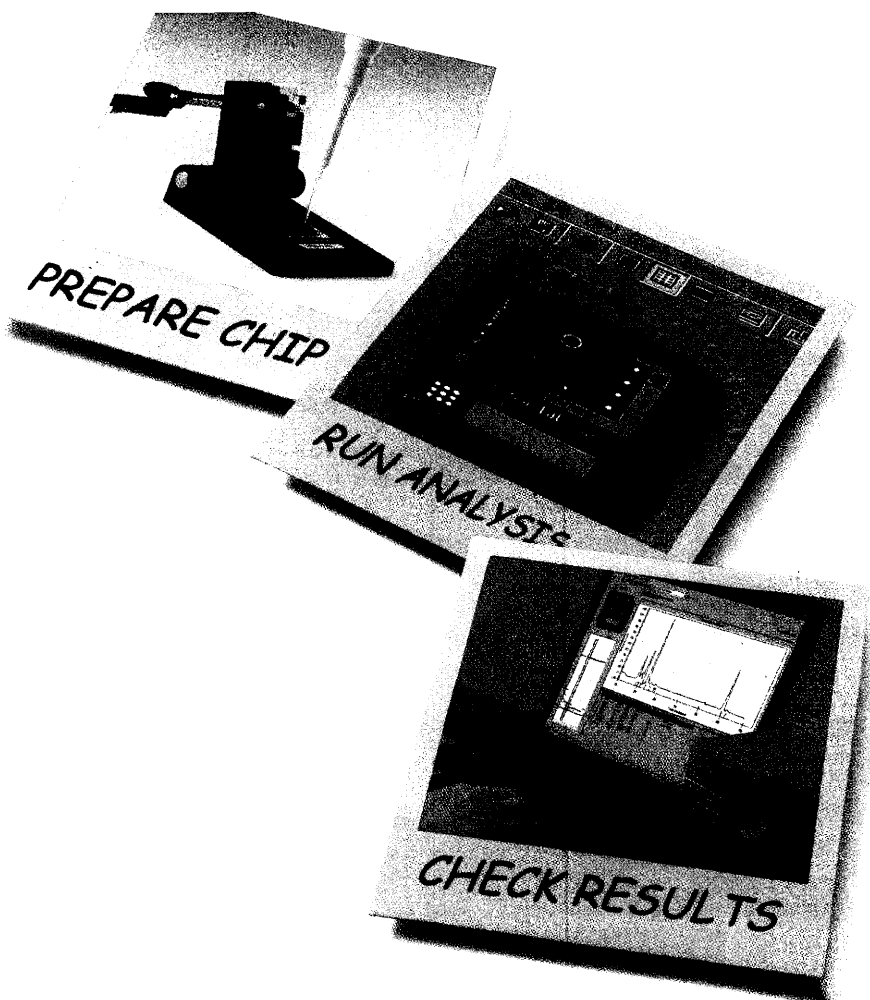
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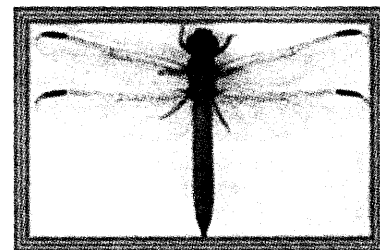
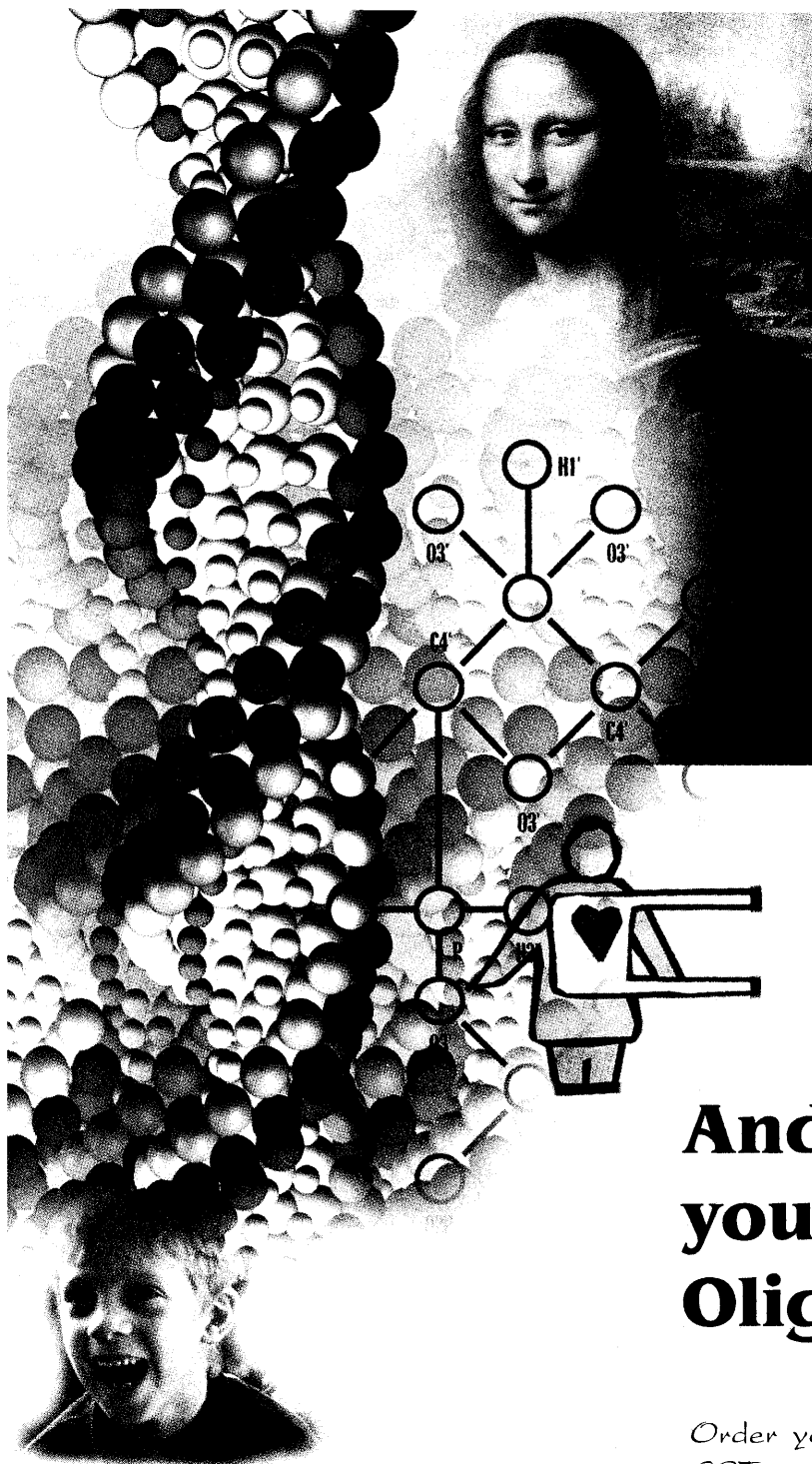
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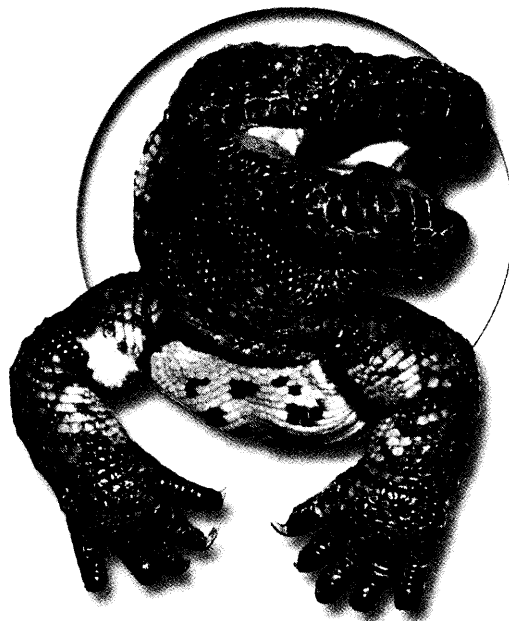
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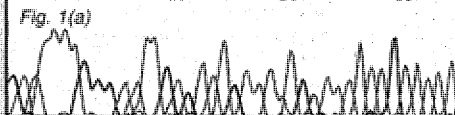
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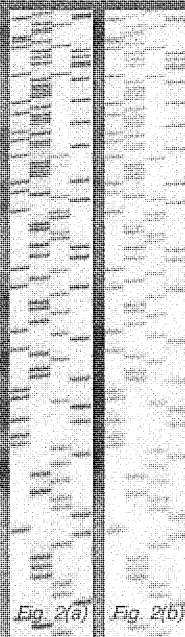
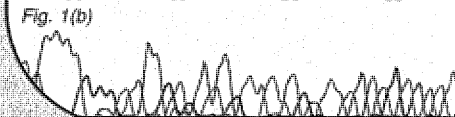
Fig. 1. Fluorescent sequencing results of a 100 bp pUC18 PCR fragment sequenced with a -20 Fwd primer using the DYEnamic ET Terminator Cycle Sequencing Kit (Amersham Pharmacia Biotech). Data generated for USB by Cleveland Genomics. (clevelandgenomics.com), a research service company. PCR clean-up performed 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.

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30 40 50 60



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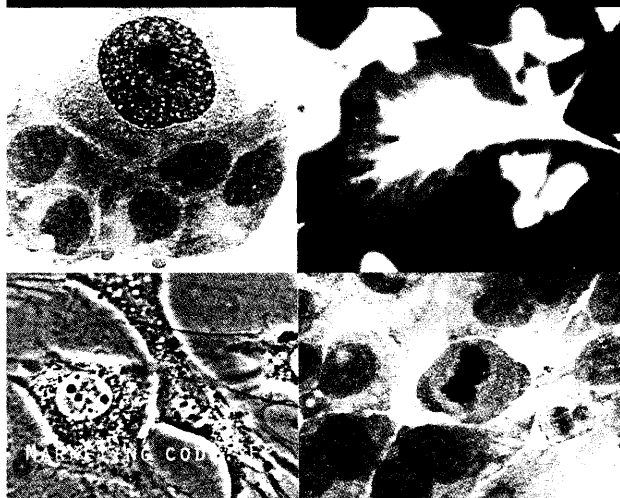
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[†]The Polymerase Chain Reaction (PCR) is covered by patents owned by Roche Molecular Systems and F. Hoffmann - La Roche Ltd. A patent pending on product. The method of use is covered by the following patents: 5,758,295 and 5,741,676.

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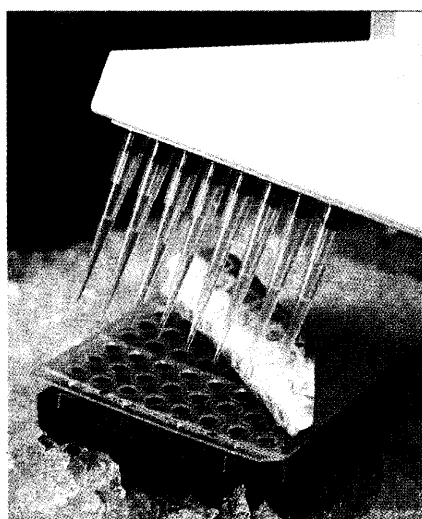
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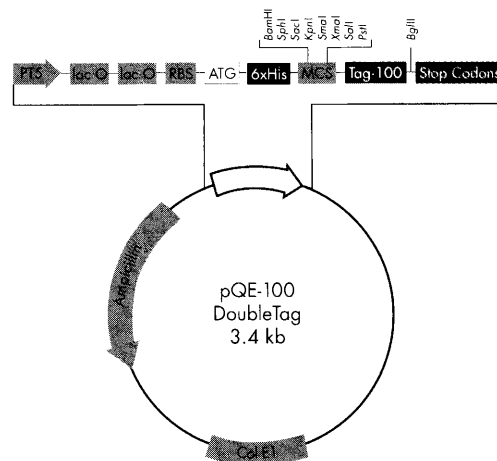
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