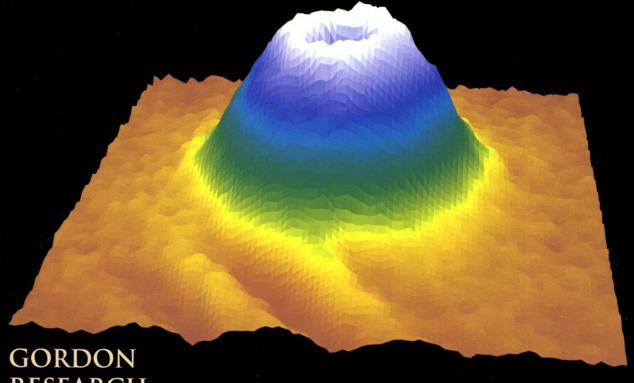
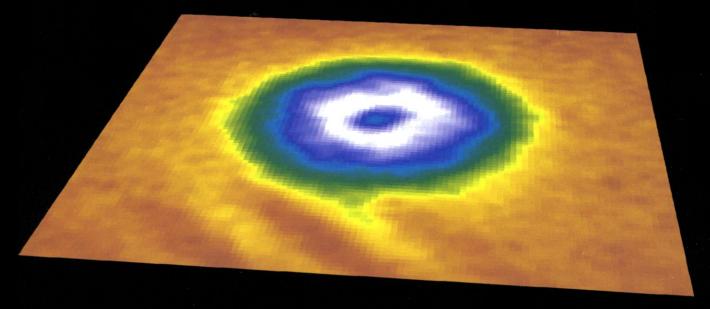
# Science 23 February 2001

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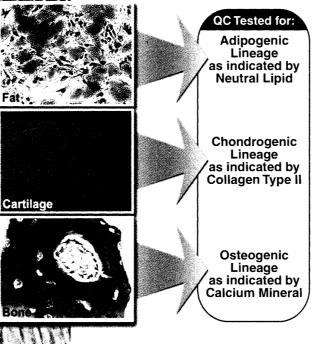
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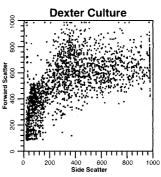


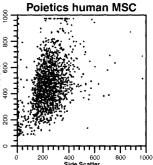
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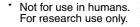
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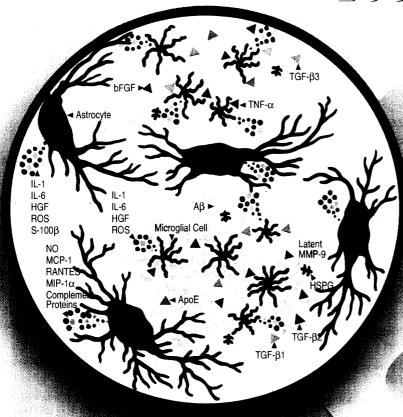
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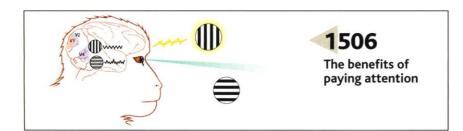
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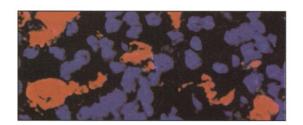
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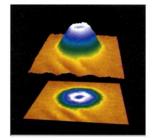
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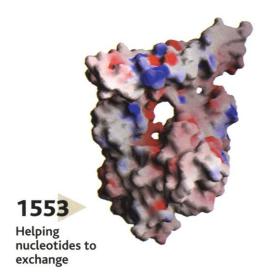
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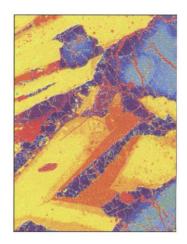
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When rotated above a critical frequency, a single quantum of circulation, known as a vortex, forms in a gaseous Bose-Einstein condensate, marking the breakdown of superfluidity in a quantum fluid. The vortex core appears in this absorption image of the rubidium atom cloud as a hole in the density profile. The Gordon Research Conference on Atomic Physics will meet at Williams College on 17 to 22 June. The summer and international conference schedules begin on p. 1569. [Image: Kirk W. Madison, Frédéric Chevy, Jean Dalibard/Laboratoire Kastler Brossel, École Normale Supérieure, Paris



**1527**How rusty is the Red Planet?

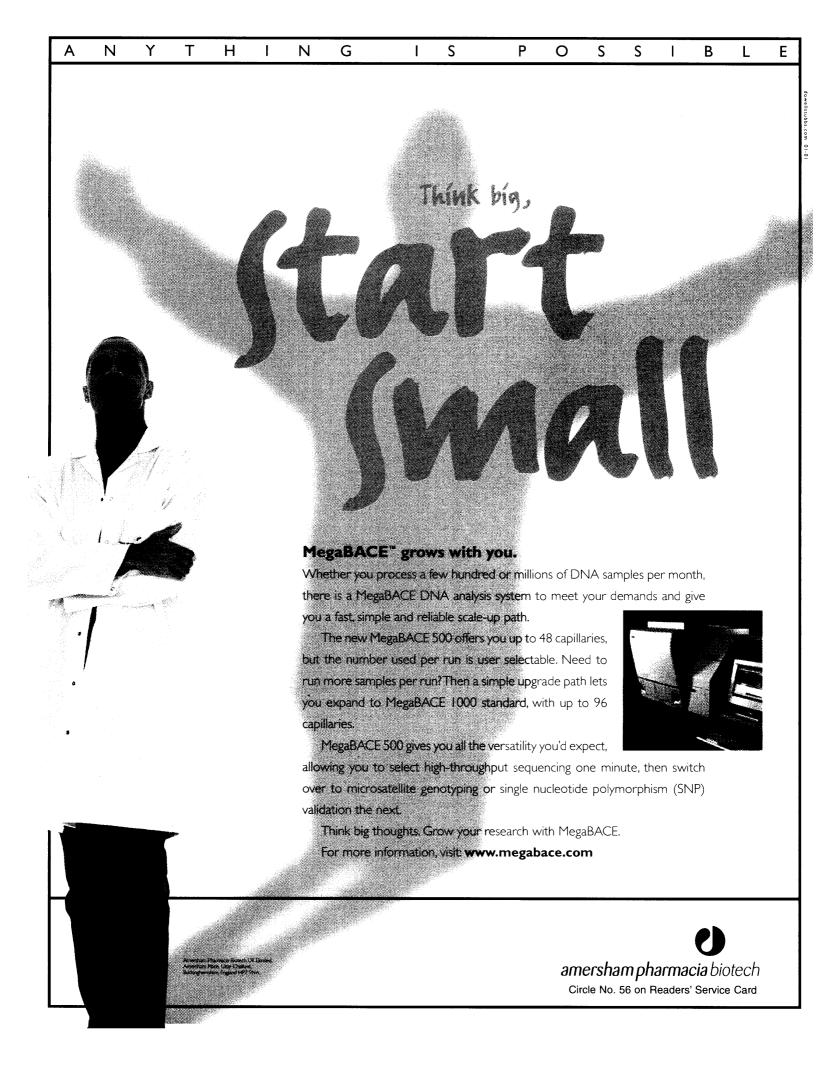


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Science magazine www.sciencemag.org

F. G. Gatti, D. A. Leigh, L. Mottier, F. Paolucci, S. Roffia, G. W. H. Wurpel

PERSPECTIVE: A Light-Driven Linear Motor at the Molecular Level J.-P. Sauvage Light speeds up molecular shuttles to the microsecond time scale.

Turing-Type Patterns on Electrode Surfaces Y.-I. Li. I. Oslonovitch, N. Mazouz, F. Plenge, K. Krischer, G. Ertl

Analogs of Turing patterns turn up at the surfaces of gold electrodes and may be observable in many electrochemical systems.

#### Length of the Flagellar Hook and the Capacity of the Type III Export Apparatus

S. Makishima, K. Komoriya, S. Yamaguchi, S.-I. Aizawa

The export apparatus apparently acts as a kind of "measuring cup" to define the remarkably uniform size of the hook structure at the base of the bacterial flagellum.

#### **TECHNICAL COMMENTS**

**SCIENCE EXPRESS** 

#### Polyploidy and Gender Dimorphism

In a study of the North American plant genus Lycium, Miller and Venable (Reports, 29 Sep. 2000, p. 2335) proposed that polyploidy may trigger gender dimorphism "by disrupting self-incompatibility and leading to inbreeding depression." Brunet and Liston argue that the analysis by Miller and Venable "does not support the claimed associations," suggest possible shortfalls in their method for measuring self-compatibility, and hold that showing the importance of the claimed associations in the evolution of gender dimorphism requires a demonstration "that gender dimorphism arises more frequently via this pathway than via other pathways." Miller and Venable cite additional phylogenetic work supporting their analysis and suggest some additional statistical tests for the notion of polyploidy as a trigger for gender dimorphism.

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/291/5508/1441a

#### stke

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Protocol: Immunoisolation of TCR Signaling Complexes from Jurkat T Leukemic Cells T. Harder and M. Kuhn

Magnetic bead isolation and nitrogen cavitation techniques for studying signaling complexes.

Book Review: A Progress Report on Translational Control in Eukaryotes M. Kozak Commentary on the book Translational Control of Gene Expression.

#### scene next wave

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#### US: Stipend Schmipend M. Sincell

Looking for ways to ease the financial burden of graduate school? Check out this week's Survive and Thrive.

#### UK: Portfolio Person C. Sansom

In this week's installment in our occasional consultancy series, Clare Sansom explains why having several strings to her bow is the key to a successful freelance career.

#### Germany: Establishing a Genome Research Network R. Metzke

With a DM 350 million financial fillip for functional genomics, the German government aims to significantly boost research into cancer, infections, and cardiovascular diseases.

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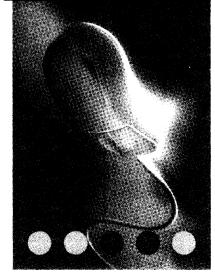
AD SUPPLEMENT IN THIS ISSUE

#### Women in Science:

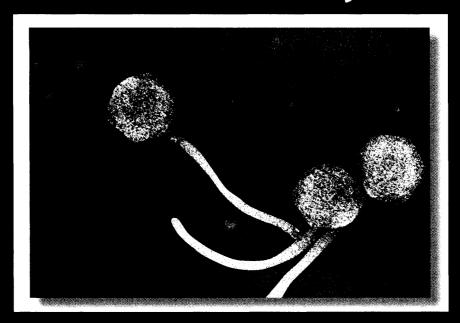
Historically, women have faced enormous obstacles in their efforts to pursue careers in science. This ad supplement addresses how companies have progressed in attracting women to their professional ranks. Look for it on page 1581.

AD SUPPLEMENT / 16 MARCH ISSUE

**Technologies in Cancer** Research: This ad supplement is focused on technologies used in the fields of biochemical pathways and how these pathways control cell division and cell death (apoptosis). Look for it in the 16 March issue.



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# SOURCE: D. J. EMLEN

# THIS WEEK IN Science

edited by Phil Szuromi

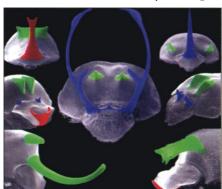
#### **ENSO Through** the Ages

The El Niño-Southern Oscillation (ENSO) is Earth's largest interannual quasi-periodic climate event. Although it is still incompletely understood mechanistically, many researchers believe that it may be sensitive to global warming. Tudhope et al. (p. 1511; see the Perspective by Cole) have analyzed corals from Papua New Guinea (located at the heart of the Western Pacific warm pool and thus perfectly situated to record ENSO-related variability) to determine how ENSO has varied in response to both glacial and interglacial conditions during the past 130,000 years. They find that it is stronger now than during any of the other seven intervals of time they examined, and they suggest that its variability is a dual function of some type of glacial dampening and solar forcing.

#### Form Follows Functional Cost 1534

Traditional explanations for elaborations of sexually selected structure (such as the elaborate plumage of birds and the horns on bee-

tles) focus on the reproductive benefits of specific ornament or weapon types. In a comparative study of beetle horns, Emlen (p. 1534; see the Perspective by Harvey and Godfray) illustrates instead how functional costs of producing these structures can lead



to the development of novel morphologies. functional costs of horn expression vary with the type of horn produced, and this factorrather than the reproductive benefits-may drive the evolutionary diversification of the beetle horns.

**New Receptors for B Cells** 

es in the fullerenes from the P-T boundary show that their isotopic composition is unlike that of Earth's atmosphere but reflects an extraterrestrial signature. Fullerenes were not identified in sediments above or below the boundary and might have been delivered to the Earth in a large comet or asteroid.

#### **Antigen Recognition Cuts Both Ways**

B cells appropriate help from T cells by expressing of class II molecules, which display antigenic peptides to specific receptors expressed by the T cells. These receptors are wired up to complex intracellular signaling pathways that launch a program of activation and differentiation in the T cell upon the recog-

nition of appropriate antigen. Lang et al. (p. 1537) provide evidence that the interaction between the T cell receptor and class II molecule is not simply a one-way exchange of information. Signals could be delivered back to the B cell via the class II molecules. This process depended upon their association with the signaling chains of the B cell antigen receptor. This process may play a role in regulating T cell-B cell cooperation during immune responses to antigen.

Expression of self-reactive receptors by B lymphocytes generally leads to their demise through clonal deletion, yet some B cells appear to escape death by swapping their existing receptors for less dangerous ones. This process of receptor editing was first revealed through the transgenic expression of self-reactive receptor chains, which artificially forced some cells to express new receptors. However, these studies could not predict the extent to which this process contributed to the B cell repertoire. By tagging one of the antibody loci in mice with a human version of the light chain  $\kappa$  gene, Casellas et al. (p. 1541; see the Perspective by King and Monroe) tracked which cells might undergo receptor editing during normal development. The results of these experiments suggest that revision of receptor specificity by B cell may be much more frequent than previously predicted.

#### **Automating Carbohydrate Synthesis**

Nucleic acids and many polypeptides can be readily synthesized by automated solid-phase synthesizers. Carbohydrate synthesis has been more labor intensive, and each step, whether in solution or

#### **Electrons Make the Long Jump**

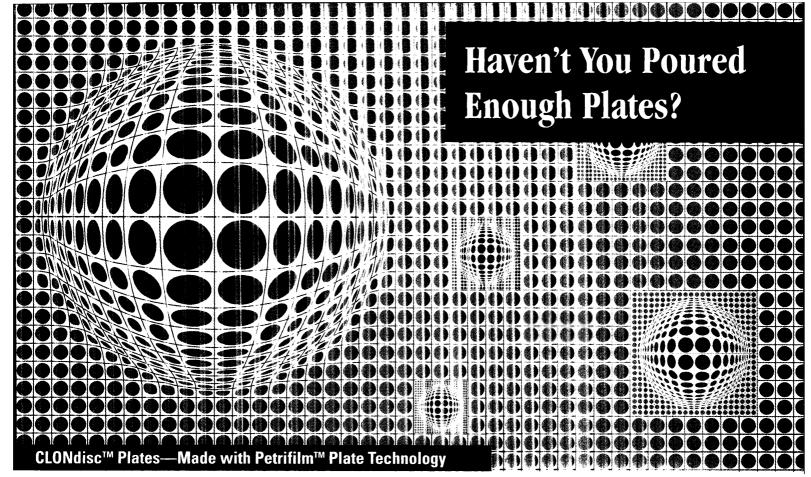
Direct electron transfer over distances of a few nanometers may be quite useful in molecular electronics, but the barriers that must be overcome to transfer electrons between donor and acceptor groups generally increase with increasing distance. In many cases, long-distance electron transfer requires an intermediate site, and the electrons actually "hop" rather than fire directly. Sikes et al. (p. 1519) present data from a thermal-jump experiment that indicates that direct electron transfer can occur over distances as great as 28 angstroms. In this case, electron transfer in self-assembled monolayers occurred through oligophenylenevinylene bridges that tethered ferrocene groups in solution to gold electrodes. The authors eliminate other possible mechanisms for electron transfer and suggest that these bridges may maintain greater planarity and thus greater orbital overlap than similar bridging groups that have been used previously.

#### **Unlocking Rare Clues**

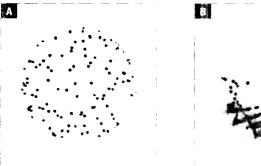
The Permian-Triassic (P-T) extinction, the largest in Earth's history, was also abrupt, lasting perhaps a few hundred thousand years. The cause of the extinction has been widely debated; unlike the Cretaceous-Tertiary extinction, there has been no compelling evidence for an asteroid impact, such as an iridium anomaly or shocked mineral grains. Becker et al. (p. 1530; see the news story by Kerr) have now isolated and analyzed fullerenes from two separate locations at the P-T boundary that seem to contain an extraterrestrial signature. Fullerenes can trap rare gases in their cages, and analyses of the gas-

**₹** Published online in *Science* Express

**CONTINUED ON PAGE 1445** 



Aleste in it spirit is the option act of Victor Vasarely





**Panel A** shows a typical CLONdisc plate inoculated with an aliquot of bacterial culture. **Panel B** shows a single colony streaked on a rehydrated CLONdisc plate. Lac+ colonies appear blue due to the presence of X-gal in the growth matrix. Lac+ colonies appear red due to the presence of TTC. Both images were obtained using an Epson 836XL flatbed scanner.

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taking advantage of solid-phase supports, is normally done by hand. Plante et al. (p. 1523; see the news story by Service, 2 Feb.) now report that several carbohydrates can be synthesized in an automated fashion with glycosyl phosphate and trichloroacetimidate building blocks supported on an octenediol-functionalized resin.

#### **Centrosomes Center Stage**

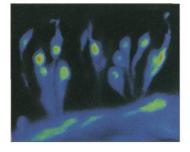
The centrosome of mammalian cells is thought to function in the organization of microtubules, particularly those that form the spindle during mitosis. Two reports provide evidence from time-lapse video-microscopy for substantial new roles for the centrosome (see the Perspective by Murray). When a cell divides, each daughter cell inherits one centrosome, which contains two centrioles: The daughter centriole, which assembled during S phase, and a mother centriole passed along from the previous cell cycle. Piel et al. (p. 1550) saw dramatic movement of the mother centriole from the center of the cell to the small intercellular bridge that connected daughter cells at the end of cytokinesis. Their observations, including experiments in which centrosomes were removed microsurgically, indicate that the final separation of the daughter cells and severing of the intercellular bridge requires the presence of the mother centriole, which stimulates disassembly of microtubules in the bridge. Hinchcliffe et al. (p. 1547) surgically removed the centrosome from African green monkey kidney cells to create karyoplasts and followed their progress through the cell cycle. Cells committed to the cell cycle did not require an intact centrosome to progress through mitosis. However, cells lacking centrosomes failed to initiate a new round of DNA synthesis.

#### Flys, Mice, and Men

Toll-like receptors (TLRs) are an ancient class of proteins utilized in antimicrobial defense. Mammalian TLRs can respond to microbial products by activating immune response genes, including those for cytokines and costimulatory molecules. Unlike Toll receptors from insects, however, a direct antimicrobial function has not been demonstrated for mammalian TLR. Thoma-Uszynski et al. (p. 1544) observed that macrophages from humans and mice could directly kill the intracellular bacterium Mycobacterium tuberculosis after stimulation through TLR-2. However, while antimicrobial activity in mice was achieved by induction of nitric oxide (NO), killing by human macrophages was mediated by a mechanism independent of NO.

#### **Leaving a Bitter Taste**

A large family of bitter-taste receptors has recently been characterized and cloned. The expression of multiple messenger RNAs of members of this family in individual cells lead to the speculation that there is only one general bitter taste and that single gustatory cells respond broadly to bitter compounds. However, Caicedo and Roper (p. 1557; see the news story by Brown) show that, in the majority of cases, individual taste cells can discriminate among different bitter stimuli. These



results are in agreement with earlier psychophysical data and the results from taste-nerve recording and indicate that there is much heterogeneity even within one subpopulation of sensory cells.

#### **Attention Leads to Synchronization**

When we look around, we perceive a multitude of stimuli in a typical visual scene. When we focus our attention onto a particular object, the other stimuli get ignored and their input is suppressed. Fries et al. (p. 1560; see the Perspective by Stryker) investigated how selective attention operates in the visual processing pathways. They found that high-frequency oscillations in area V4 are enhanced in neurons that encode attended stimuli. These results support the hypothesis that attention modulates synchronized neuronal activity.

Published online in Science Express

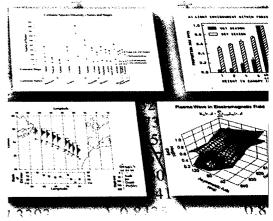


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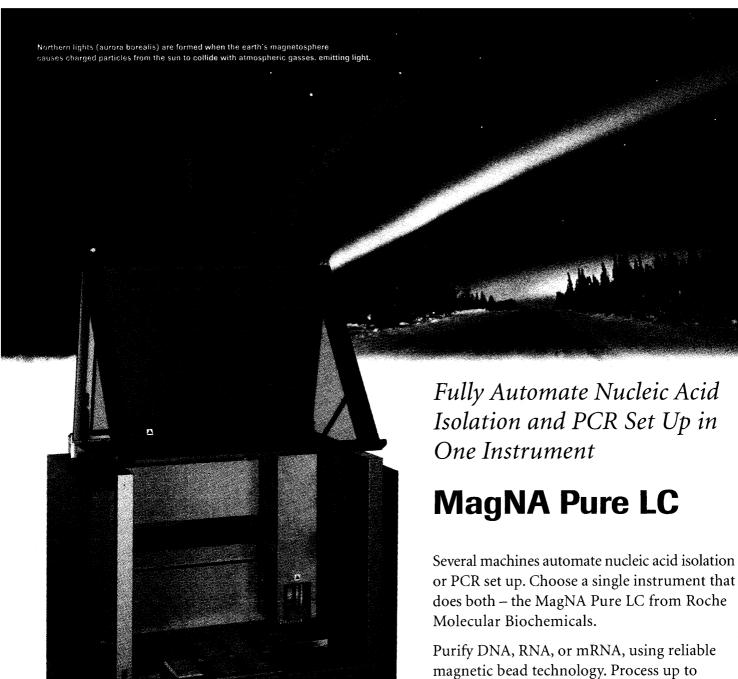
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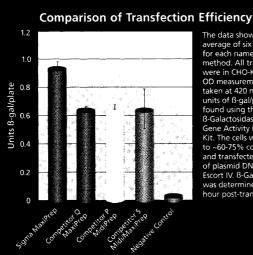
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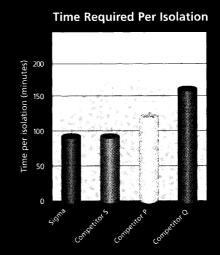
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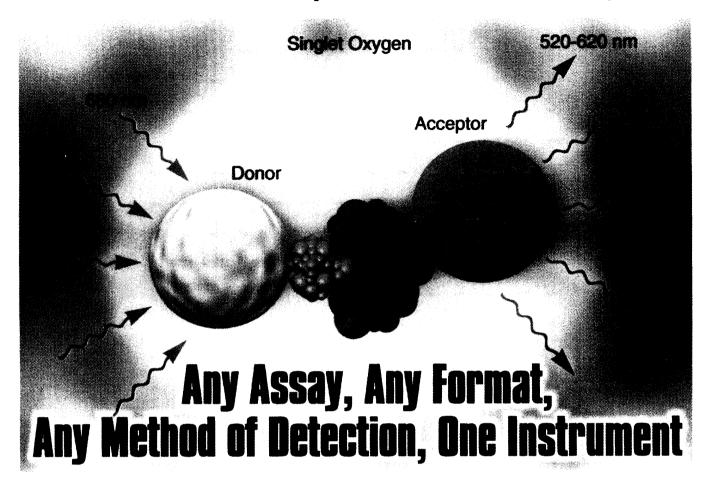
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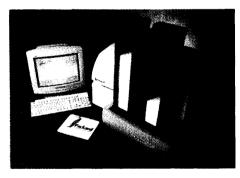
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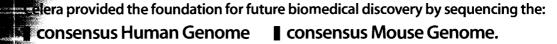
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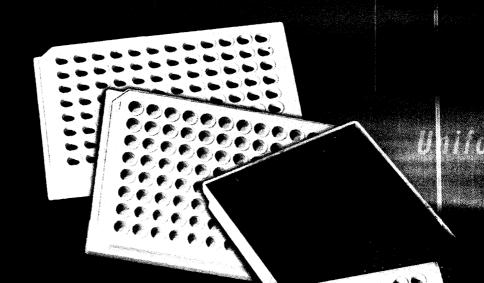
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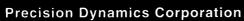
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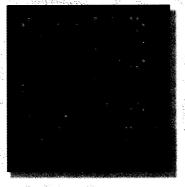
The first microarray detection kit that:

- 1. Works consistently
- 2. Works with <1 microgram of total RNA
- 3. Works with a fast, easy protocol

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#### 3DNA

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#### It works consistently.

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#### It works with submicrogram total RNA samples.

For those of you working with human tumor samples, this advance literally changes the world. Until now submicrogram detection was not possible without sample amplification and all the disadvantages associated with that technique, including bias. With 3DNA Submicro kits, for the first time you are assured accurate results with the smallest samples. (Just look at the image to the left.)

#### It works with a fast, easy protocol.

The 3DNA Submicro kit's protocol is short, simple and well defined. (In fact, one version of the protocol eliminates all concentration and centrifugation steps.) Total "hands on" time is only 20-30 minutes. Without question the utter simplicity of the 3DNA Submicro protocol makes possible its exceptional reliability.

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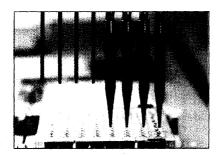
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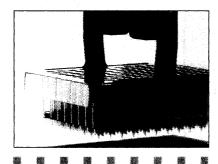
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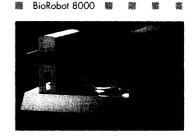
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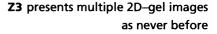
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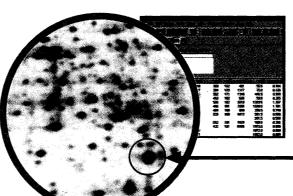
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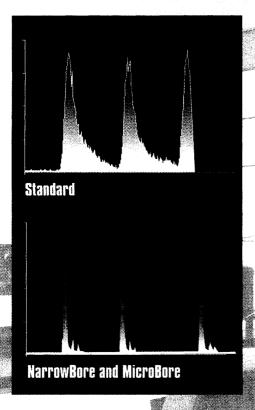
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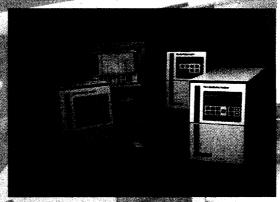


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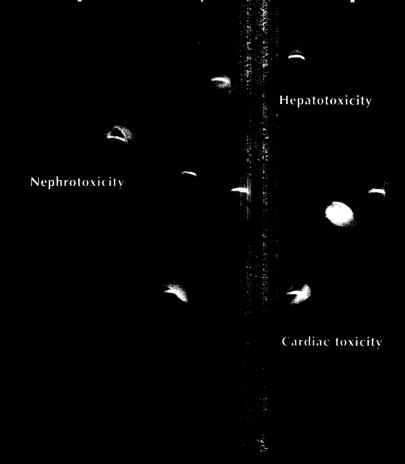


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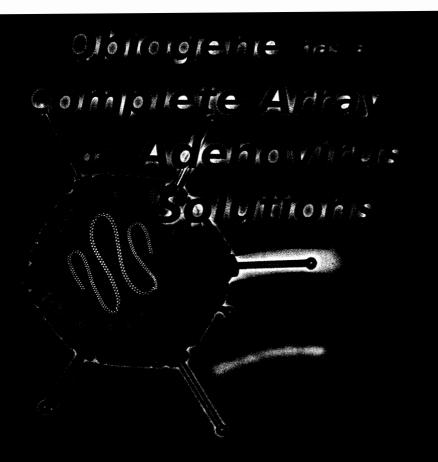


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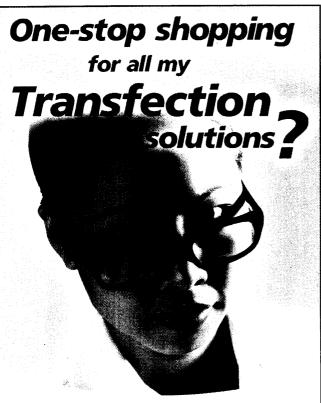
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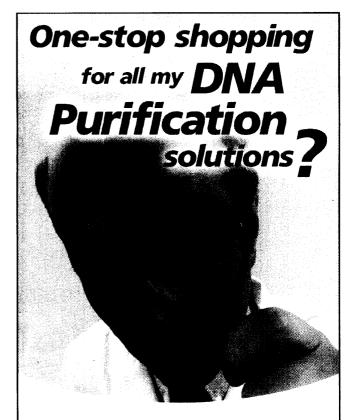


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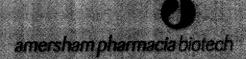
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# 



# P(R product analysis



Fluorescently labelled DNA size ladders and PCR products (between 0.25 and 5 fmol per band) loaded in the same lanes were separated in a polyacrylamide gel. Fluorescein (green), Cy"3 (yellow), ROX" (blue) and Cy5 (red) labels were used.

#### • High sensitivity

- Detect amol levels of fluorescent labels

#### Versatility

 Detect a variety of popular dyes such as fluorescein, ethidium bromide, HEX™, TET, JOE, ROX, CyDye™ and Alexa Fluor™ dye series

#### • Automated four-colour fluorescence scanning

- Analyse multiple targets in the same gel and in the same lane
- Accurately determine fragment size
- Increase throughput and save time

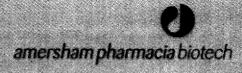
#### Simplicity

- Read acrylamide gels sandwiched between glass plates
- Monitor the run without ruining the gel—image gel without introducing bubbles or tears

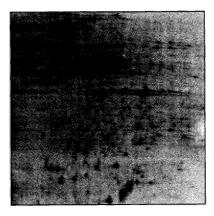
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# 2-D protein gel analysis



Protein extract from Ecoli was focused on Immobiline" DryStrip gel before resolution in a second-dimension SDS polyacrylamide gel. SYPRO" Ruby staining of the gel is shown.

#### • High sensitivity

 Detect as little as 3 ng of protein per band stained with SYPRO Ruby

#### Accuracy

- Obtain uniform images with the perpendicular scanning mechanism of Typhoon
- Detect and accurately quantify protein expression levels
- Identify spots with high precision for further analysis using mass spectrometry

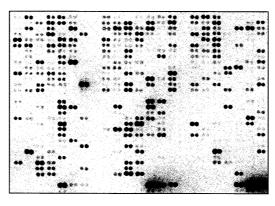
#### • Throughput

- Scan two standard 2-D gels simultaneously using  $35 \times 43$  cm scan area

#### • Simplicity

 Place your sample directly on a glass platen without the need for a sample tray

# Macroarray analysis



Atlas" macroarray hybridized with <sup>33</sup>P labelled cDNA probe and imaged on a GP storage phosphor screen.

#### • High sensitivity

 Detect <sup>32</sup>P and <sup>33</sup>P with unsurpassed sensitivity due to low, uniform background

#### Accuracy

- Obtain uniform images with the perpendicular scanning mechanism of Typhoon
- Resolve closely spaced array elements
- Accurately identify differential gene expression

#### • Throughput

 Scan multiple arrays simultaneously using 35 x 43 cm scan area

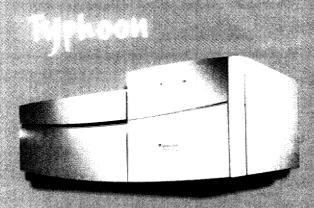
#### Simplicity

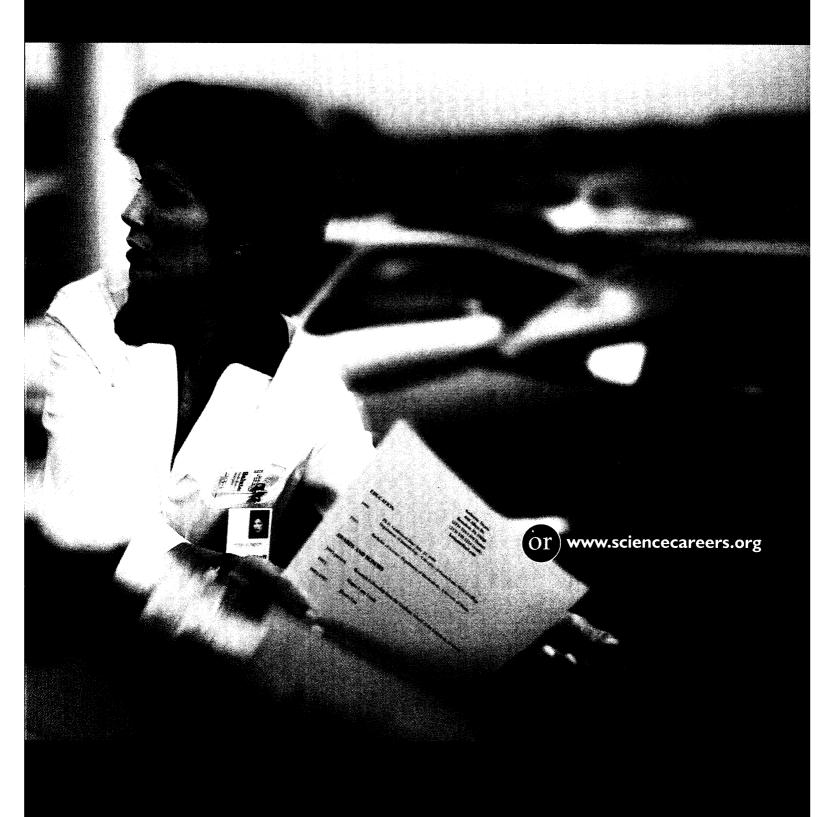
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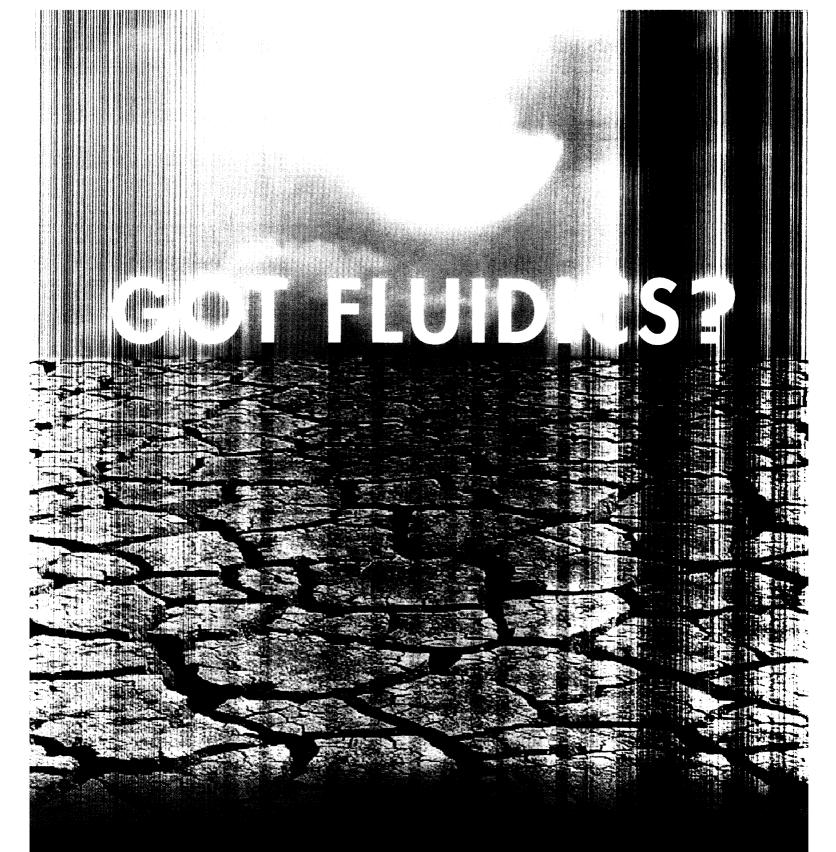




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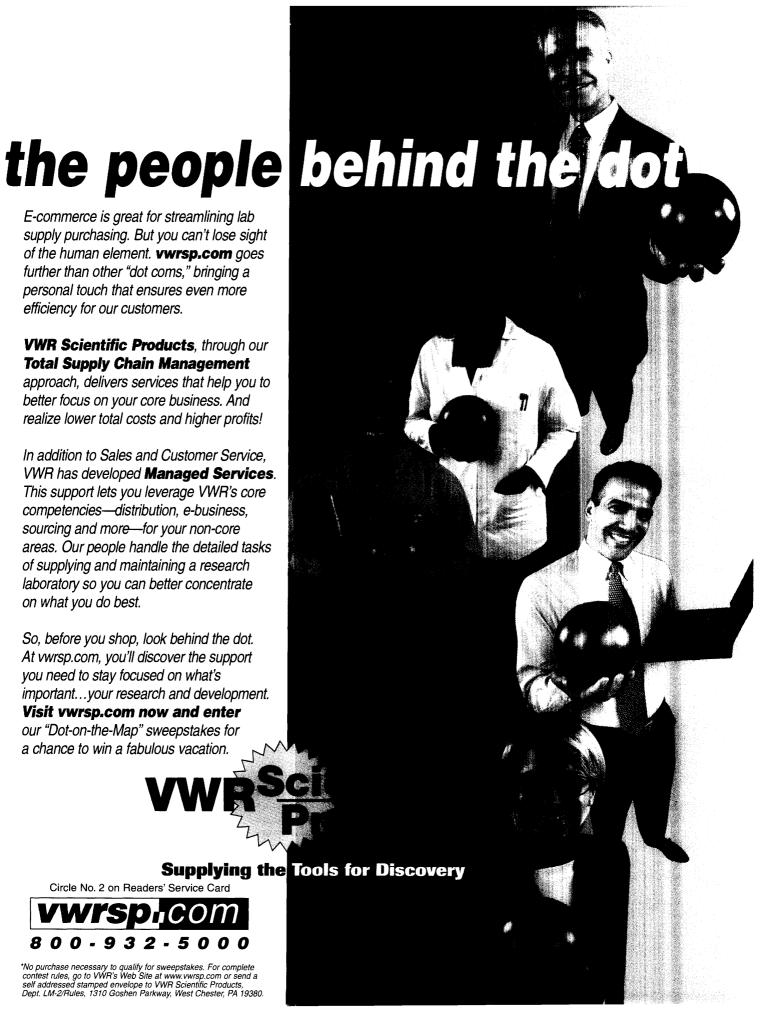
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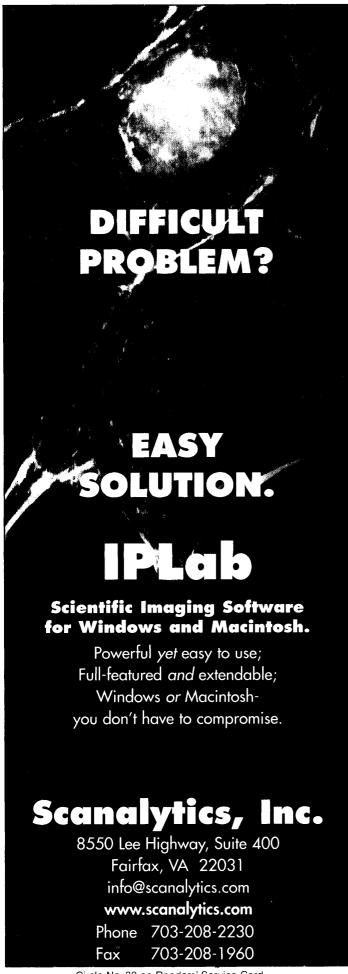
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high-density storage media such as CD-ROMs, provides excellent alternatives for delivering such information.

The Dictionary of Natural Products on CD-ROM (DNP-CR) has several noteworthy features. Users access the database of natural compounds by entering information into the search engine. Common, technical, or scientific names can be entered and a variety of Boolean functions are available to define sophisticated searches. The program accesses the database in a very rapid manner, but even if the "View Hits" option is checked, DNP-CR does not present the results of the search until the user clicks on the Hit List button. Double-clicking on an item in the list brings up its complete record. This includes the compound's name, structure, various chemical registry numbers (CAS, Chapman and Hall), its natural source(s), its commercial source(s), the importance or use of the compound, its physical properties, and any relevant references.

The retrieved record includes access to the chemical structure in a module in which users can make alterations. The module is a reasonably useful drawing program. It can import and export structures in DARC, SMD, MDL, and ALC formats. It recognizes valences and provides basic drawing functions, e.g., rings, double bonds, single bonds. Structures drawn by users can be used as search criteria for retrieving information from the database. Though the interface for performing the searches is confusing, I was able (after several tries) to locate records by this type of search.

The problems with the drawing program are the only significant shortcomings of the package. A minor problem was encountered while trying to access the documentation. If a user attempts to do this within the program, it tries unsuccessfully to open a very old version of Adobe Acrobat Reader. This was easily fixed, however, by opening the documentation through Acrobat Reader 4.0, rather than through the program. Overall, DNP-CR effectively uses powerful searching tools to deliver database information. The software is quite useful, but its steep price will keep it out of the hands of casual users.

-Kevin Ahern

Department of Biochemistry and Biophysics, Oregon State University, Corvallis, OR 97331, USA. E-mail: ahernk@ucs.orst.edu

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the benefits of multiphoton microscopy, which include increased depth penetration and reduced photobleaching, leading to extended organism lifetimes.

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#### LITERATURE

The Radiometry of Light Emitting Diodes (LEDs) is a 14-page technical guide that includes discussions of optical characteristics of LEDs, comparison of LED measurement with photometers and spectroradiometers, and radiometric

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