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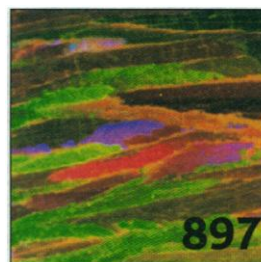
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**COVER** Carbon and phenolic inverse opals can be more opalescent than gem opals because cages replace the periodic silica spheres of the natural gem. The colors change when liquids fill the cages, as for the pictured water-filled phenolic inverse opal (image width ~17 mm). The ability to form periodic arrangements of cages on the scale of optical wavelengths for many materials, including diamond, may be important for obtaining useful electronic and optical properties. [Image: A. A. Zakhidov, I. Khayrullin]



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The communication of science

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Cell fates in filamentous cyanobacteria

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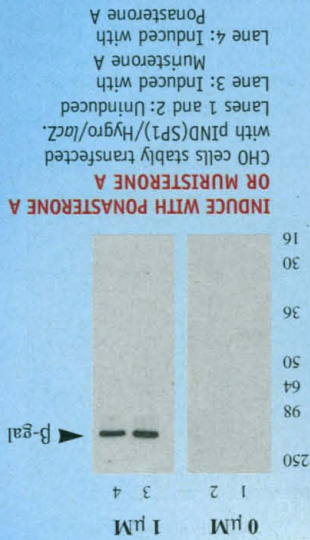
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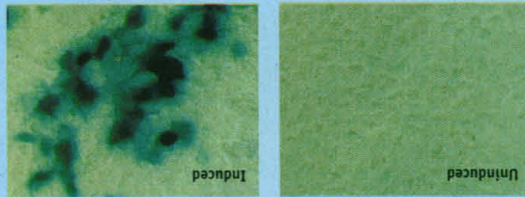
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## BETTER WITH A TWIST

The second-order nonlinear optical responses of chiral molecules, such as frequency doubling, can be enhanced by supramolecular ordering. Verbiest *et al.* (p. 913) show that Langmuir-Blodgett films of substituted helicene molecules form helical fibers. Films of one molecular handedness are better organized and show much stronger second-order nonlinearity (by a factor of 30) than films of racemic mixtures. These helicene molecules would not normally be expected to exhibit high second-order effects, but the formation of chiral helical bundles enhanced certain components of the susceptibility tensor describing optical nonlinearity. The ability to form layers of opposite chirality will be useful for generating thicker films that maintain their nonlinear properties through quasi-phase-matching methods.

## PATTERNS OF DEWETTING

Theoretical studies have pointed toward the formation of particular patterns, called spinodal modes, when a liquid film is deposited onto a substrate that is not wetted by the film. However, the experimental observation of these patterns has been difficult because they cannot easily be separated from other surface phenomena, such as the nucleation of dry patches at substrate defects. Herminghaus *et al.* (p. 916; see the Perspective by Reiter) provide experimental evidence for spinodal dewetting behavior in two systems, liquid crystal and liquid metal films. They can rationalize the observations in terms of the different forces dominant in the two systems.

## SHAPING CHEMICAL REACTIONS

Although in principle it should be possible to use carefully prepared laser pulse sequences to control the outcome of chemical reactions such as photodissociation, in practice it is difficult to anticipate all of the possible outcomes as different states interact on different time scales. Assion *et al.* (p. 919) circumvent this difficulty by using an evolutionary algorithm to adjust the input laser pulse to a reaction to maximize formation of a particular product. Tailoring of femtopulse sequences allowed either of two different bond-cleaving reactions of an iron complex to be selected.

## OPALESCENT CARBON

Ordered macroporous materials with three-dimensional periodicities on the scale of optical wavelengths are of interest, for example, as photonic band gap

materials (which have band gaps for the propagation of photons at specific frequencies, allowing the control of light through the material). Zakhidov *et al.* (p. 897; see the cover and the Perspective by van Blaaderen) prepare microporous carbon materials via a synthesis route resembling the geological formation of opal, a gem consisting of small silica spheres with hydrous silica filling the voids between the spheres. They infiltrate crystals made of sintered silica spheres with carbon precursors and subsequently extract the silica. A range of ordered, stable materials with different properties of the wall materials depending on the synthesis conditions can be made that have periodicities at optical wavelengths.

## LONG-TERM AGROECOSYSTEM EXPERIMENTS

Is world food production sustainable? What influence will global change have on ecosystems? Can historical trends in atmospheric contaminants be determined? Such questions are difficult to answer, in part because



the ecological processes involved are slow and short-term studies often fail to detect trends. Rasmussen *et al.* (p. 893) overview the contribution that a small number of long-term agroecosystem experiments (in some cases dating back to the middle of the last century) have been making in assessing changes in the environment and their influence on agricultural and natural ecosystems.

## A THIN SKIN ON THE INNER CORE

Seismic waves travel faster through the inner core in a north-south direction than waves that travel east to west. Song and Helmerger (p. 924) present evidence for a subtle layer in the inner core based on analysis of seismic waves that traverse or reflect off of the inner core beneath the

central Pacific Ocean. They use unusually broad pulses from long-period inner-core seismic waves, anomalous reflections from short-period inner-core waves, and a possible triplication of the short-period waves to model a thin isotropic outermost shell of randomly oriented iron grains (about 200 kilometer maximum thickness) that surrounds an anisotropic innermost core of iron grains aligned along a north-south direction. Such a model can be used to test theories about the geodynamo, the cooling of the core, and the structural transition between the inner and outer core.

## ISOTOPIC GROWTH

Crystals of different isotopes of an element will have different lattice constants, but this effect is extremely small, typically on the order of 1 in 100,000, and is difficult to measure. Previous measurements have been made on isotopically pure single crystals, which can be hard to obtain at the level of perfection required for such measurements. Kazimirov *et al.* (p. 930) have grown germanium-76 films epitaxially on a normal germanium substrate and measured the small lattice mismatch between them by Bragg diffraction. Good agreement with theory is obtained for the temperature dependence of the effect.

## WATCHING AN ENZYME AT WORK

To a geneticist, RNA polymerase initiates the process of gene expression by making a single-stranded RNA copy of the double-helical DNA genome. To a biochemist, RNA polymerase strings together single ribonucleotide triphosphates in a sequence dictated by the DNA template. Wang *et al.* (p. 902) use an optically controlled gauge to measure force and velocity online, revealing how RNA polymerase appears to a physicist: moving at constant speed at times, pausing at other moments, and even moving backward occasionally.

## TESTING MALE FITNESS

Haldane's rule predicts that the fitness loss from hybridization between species will affect the viability and fertility of the heterogametic sex more than the homogametic sex. Presgraves and Orr (p. 952; see the Perspective by Turelli) study two genera of mosquito to test theoretical explanations for Haldane's rule. Analysis of the structure of the Y chromosomes and the effects of hybridization on fertility and viability reveal some of the mechanisms operating behind Haldane's rule.

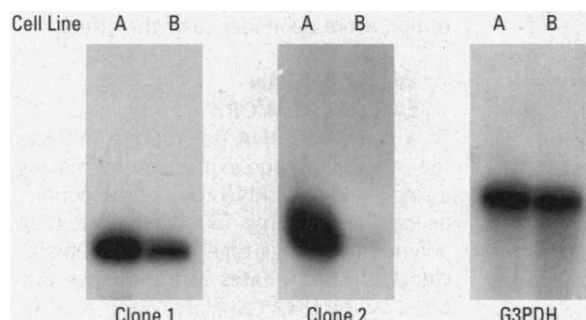
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# THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 841

## PLANNING A COLONY

Filamentous multicellular colonies of the cyanobacterium *Anabaena* require both photosynthesis and nitrogen fixation, but these processes must occur in different cells. Determination of the fate and organization of these two cell types within the colony represents a simplified case of pattern formation. Yoon and Golden (p. 935; see the Perspective by Haselkorn) have identified a small peptide signal that emanates from one cell type to inhibit differentiation of similar neighbors. Thus, through cell-cell signaling, the nitrogen-fixing cells form a pattern distributed throughout the colony of cyanobacteria.

## HEPATITIS C VIRUS TARGET

Approximately 70 million people worldwide are chronically infected with hepatitis C virus (HCV), which can result in hepatitis, cirrhosis, and liver cancer. The inability to infect cells with HCV in vitro has made it difficult to study events in the virus life cycle that could provide clues to vaccines and therapeutic strategies. Pileri *et al.* (p. 938) have found that the viral envelope protein E2 binds to the major extracellular loop of the human protein CD81. Only chimpanzees who had been vaccinated with the viral envelope and resisted subsequent viral infection had antibodies that inhibited the ability of HCV to bind to CD81.

## STICKING WITH IT

Inflammatory sites entice leukocytes to leave the circulation and move into the surrounding tissue. One of the adhesion molecules that participates in this process is CD44. Maiti *et al.* (p. 941) found that a

cytokine commonly produced at such sites, tumor necrosis factor- $\alpha$ , increases the adhesiveness of the CD44 on leukocytes by stimulating the cells to decorate CD44 with sulfate, not by inducing increased production of CD44. Thus, sulfation is a regulated, inducible process that contributes to the increased adhesiveness of leukocytes and that may aid their function during inflammation.

## LONG LIVE ... THE FLY

Understanding the process of aging may help in extending life-span and in maintaining improved quality of life. Lin *et al.* (p. 943; see the news story by Pennisi) isolated a mutant fly, *methuselah*, with a 35% increase in average life-span. The mutation was confined to a single gene that also confers improved resistance to stress. The *methuselah* gene product is related to a set of receptors involved in cellular signal transduction.

## LESS AGGRESSIVE, MORE SUCCESSFUL

Why are certain organisms so successful when introduced into a new environment? One possibility is behavior modification. Holway *et al.* (p. 949; see the news story by Strauss) identify loss of intraspecific aggression—and a concomitant lack of territoriality—in an introduced species of ant. In its native range, the Argentine ant exhibits pronounced aggression, but seldom do colonies introduced in southern California. In paired lab combinations, nonaggressive colonies have lower mortality and actually cooperate, providing significant advantages over aggressive, territorial combinations.

## TECHNICAL COMMENT SUMMARIES

### Ebola Virus, Neutrophils, and Antibody Specificity

The full text of these comments can be seen at [www.sciencemag.org/cgi/content/full/282/5390/843a](http://www.sciencemag.org/cgi/content/full/282/5390/843a)

Z.-y. Yang *et al.* reported that the secreted glycoprotein (sGP) of Ebola virus interacted with human neutrophils through the CD16b surface receptor (Reports, 13 Feb., p. 1034).

T. Maruyama *et al.* comment that the study "did not exclude the possibility that the rabbit antibody used to detect the binding of Ebola sGP" mediated the interaction between virus and cell. They "performed flow cytometry to study the putative interaction of sGP with neutrophils" with human and rabbit monoclonal antibody fragments specific for sGP. They "could not detect any binding of sGP to neutrophils." They also did not observe absorption of sGP by purified neutrophils. They conclude that "Ebola sGP does not bind Fc $\gamma$ RIIIb (CD16) or any other receptor on neutrophils.

In response, Yang *et al.* confirmed the inability to detect binding with an antibody fragment. However, they give several reasons for this result, and they performed a new experiment, which suggests that the explanation provided by Maruyama *et al.* "does not account for all of the available data." "Additional studies," they say, "will be required to determine whether CD16 is directly or indirectly responsible for the interaction." (Yang *et al.* also provide a correction to the far-left graph of figure 1A of their report.)

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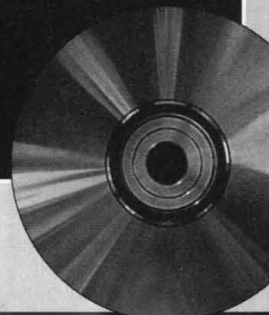
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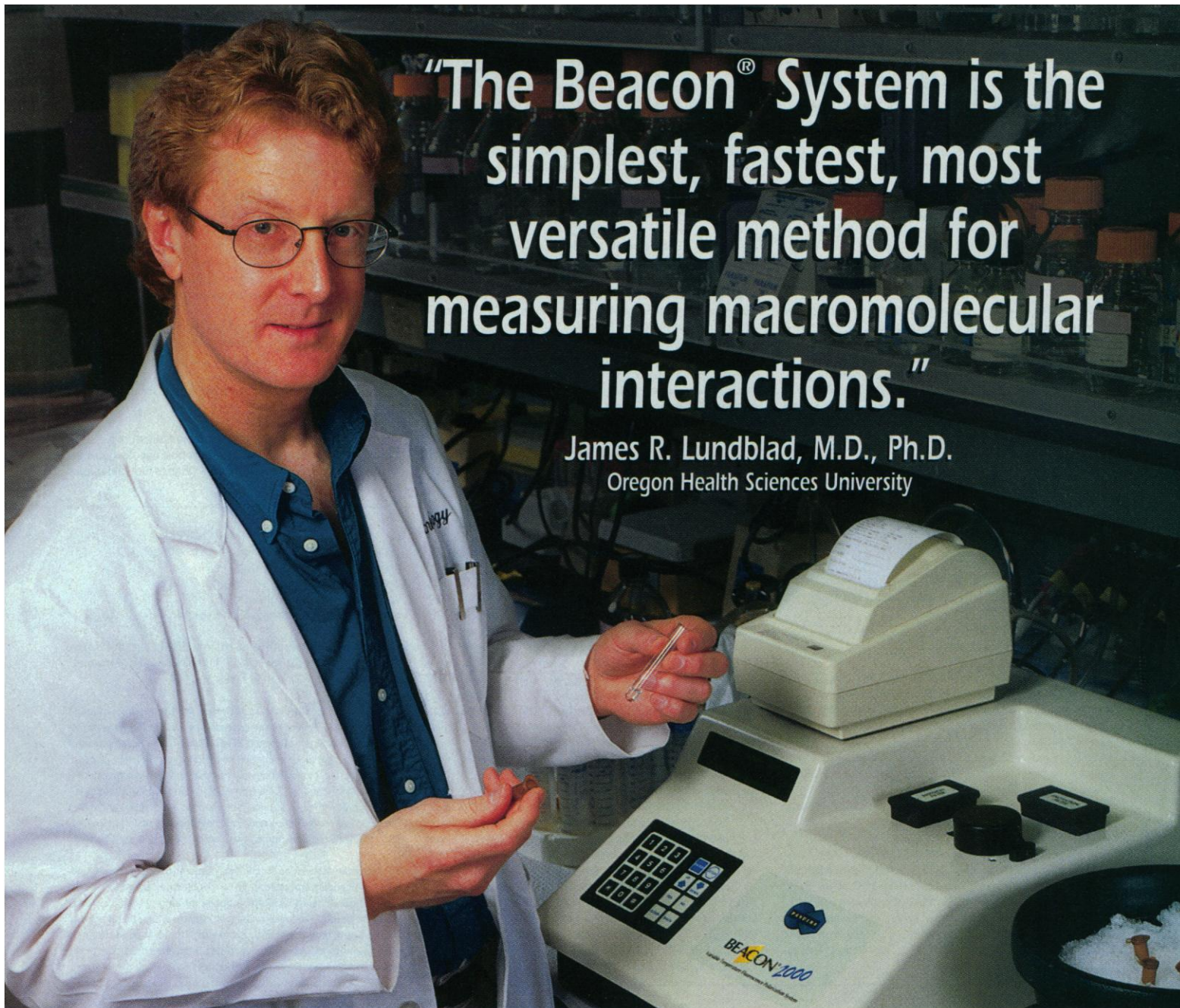
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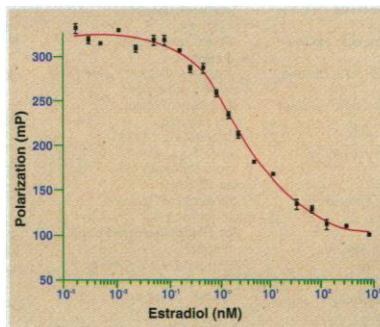
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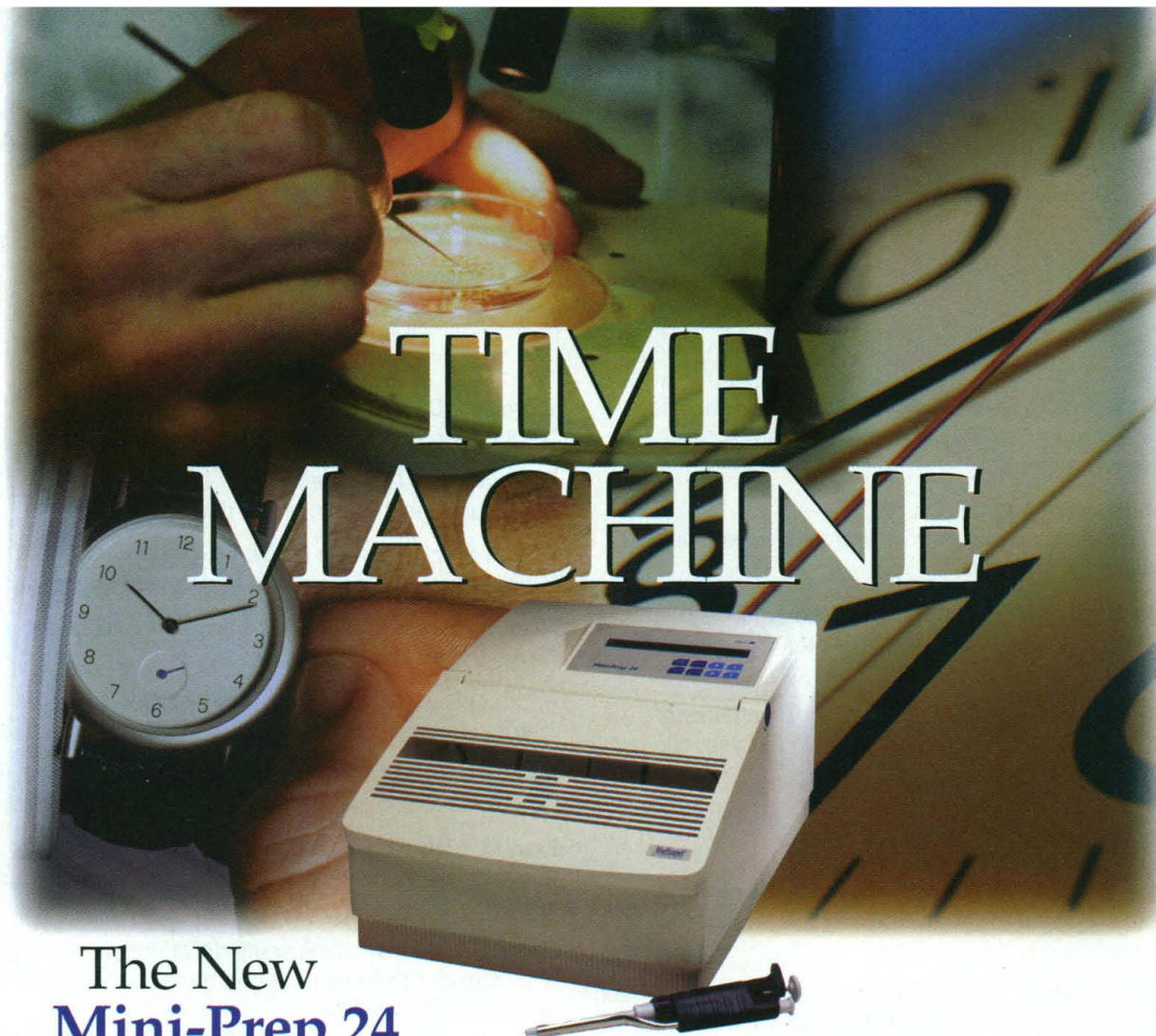
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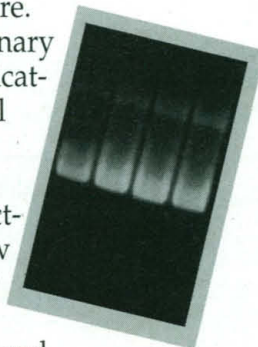
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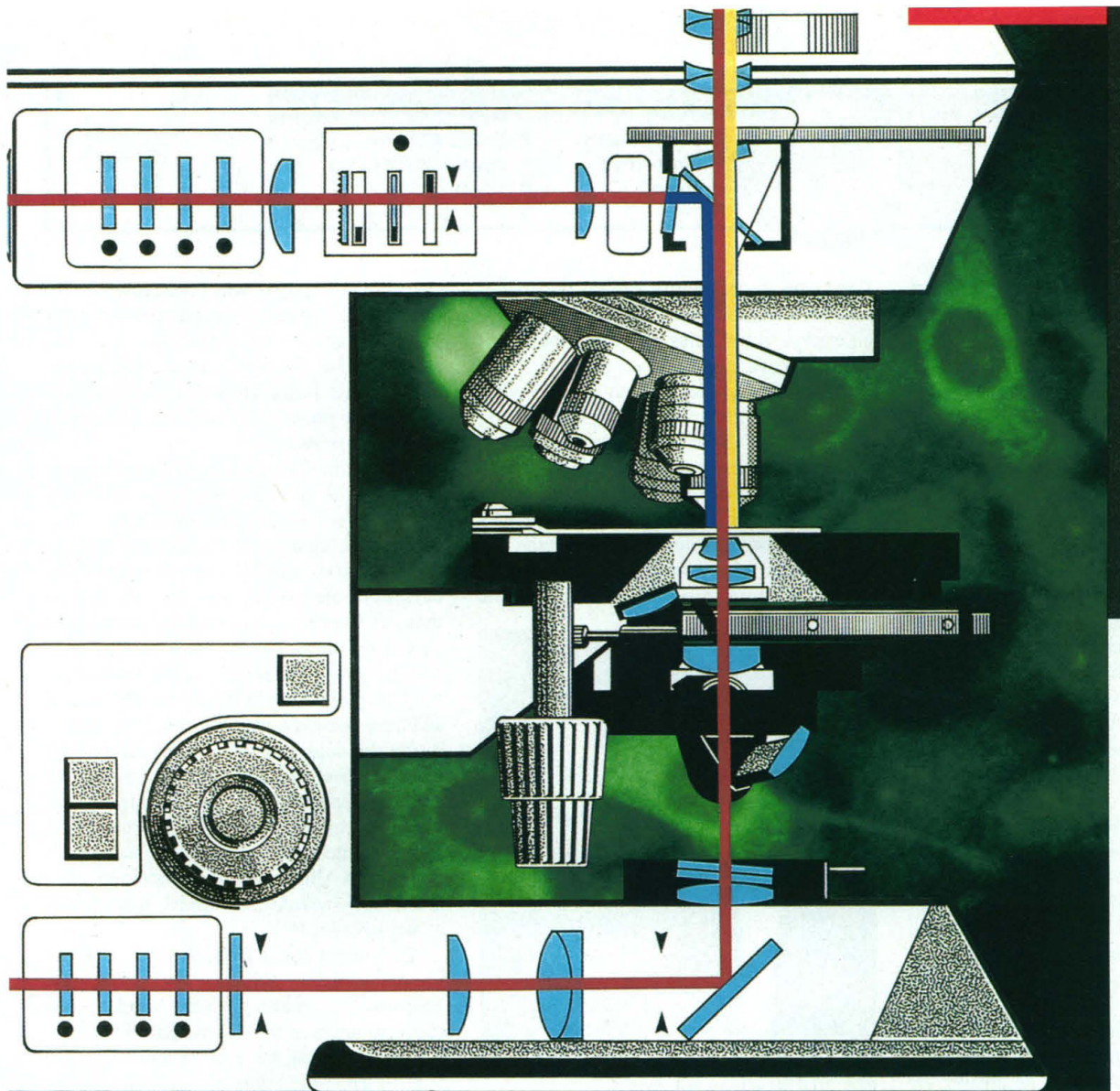
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Background picture: Insuline, computer generated molecular model

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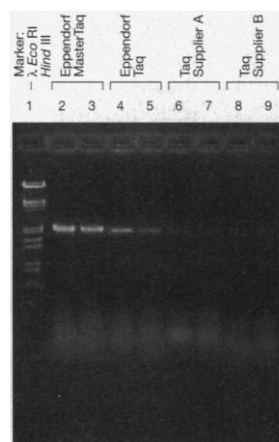
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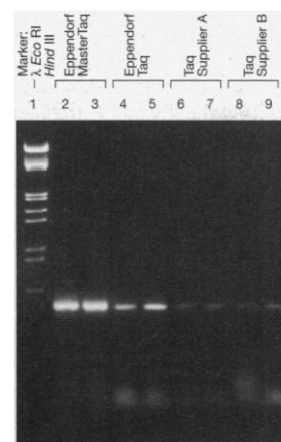
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● Fig. 1: Amplification of a SSU rRNA gene from total genomic algae DNA  
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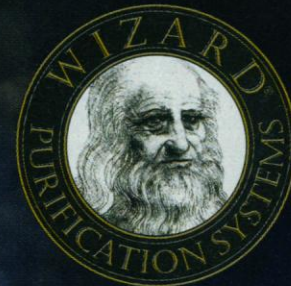
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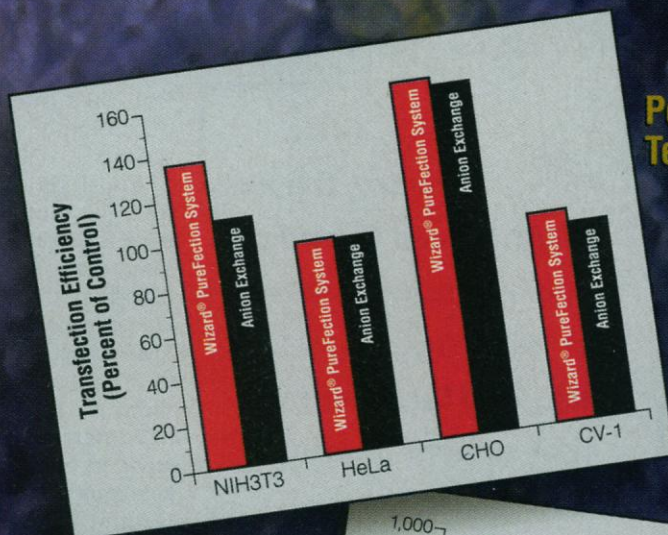
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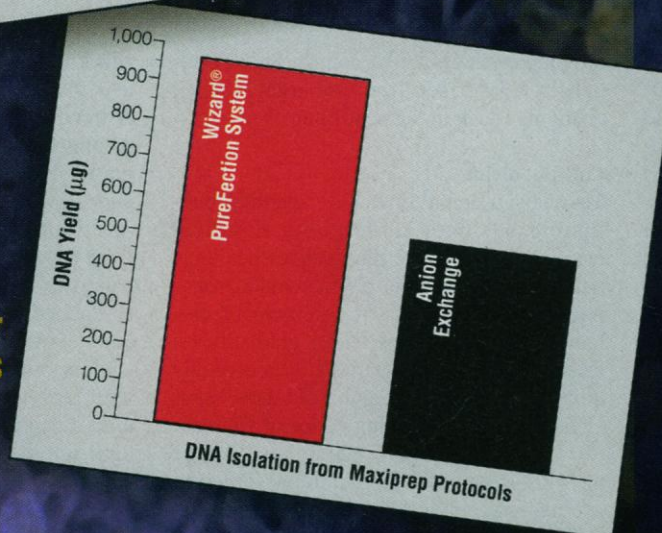


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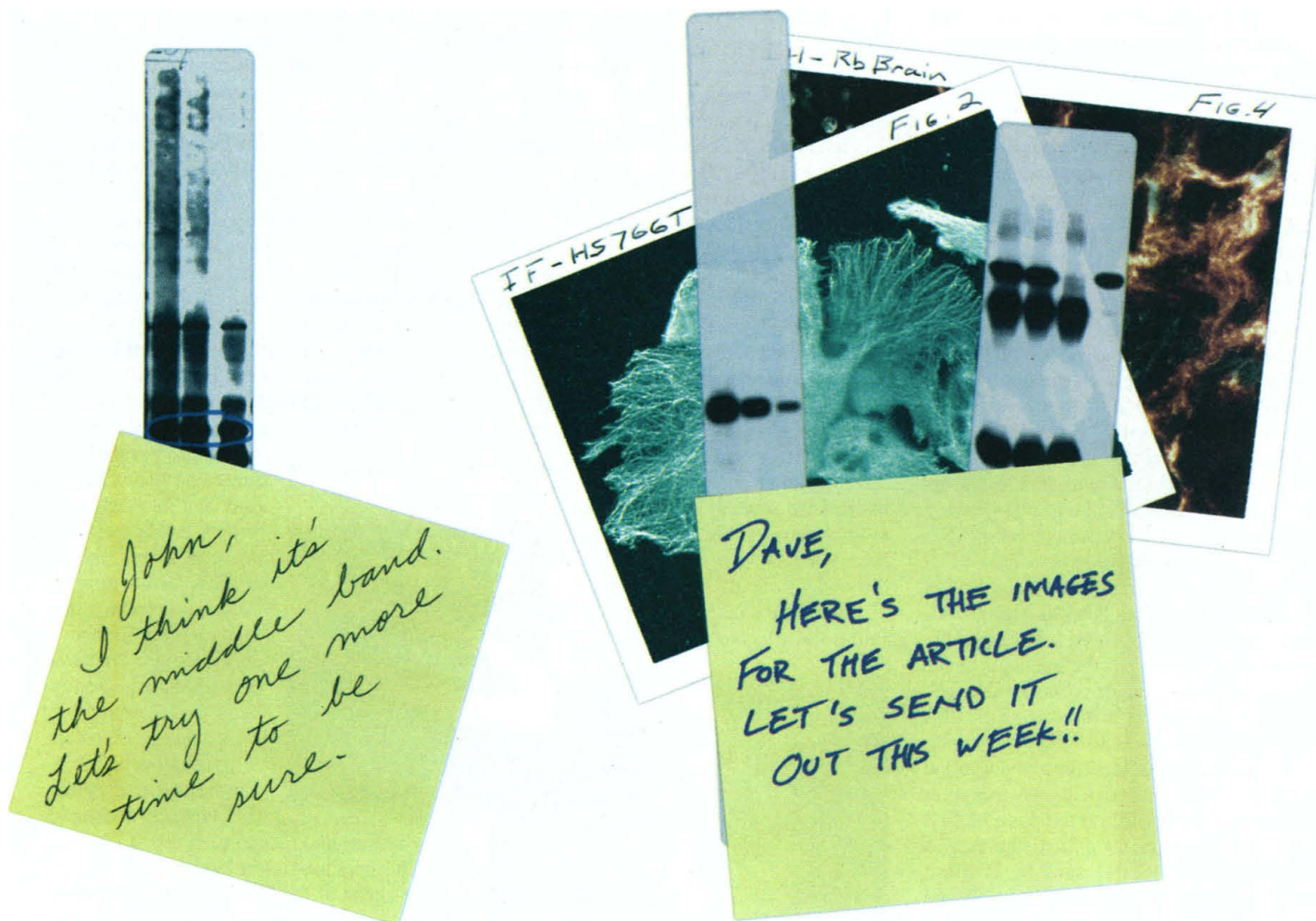
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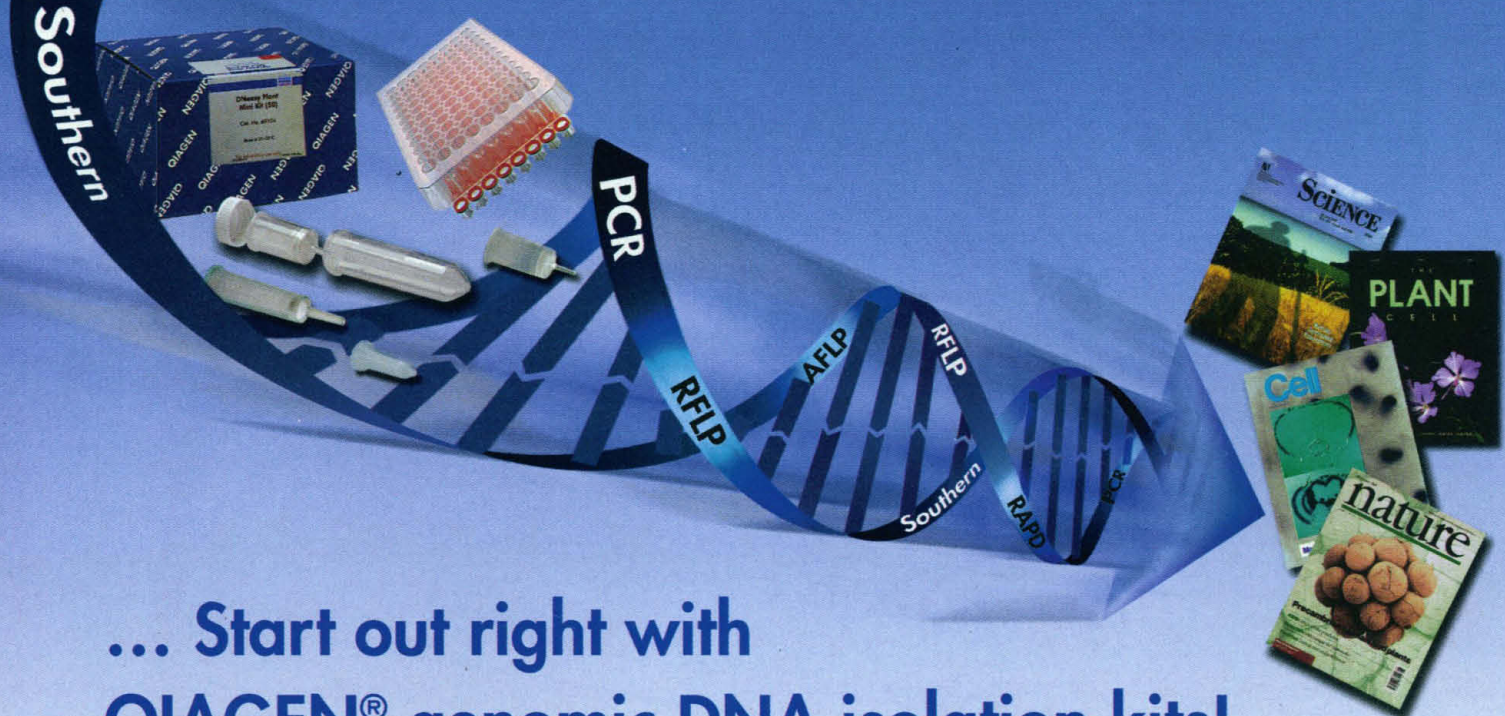
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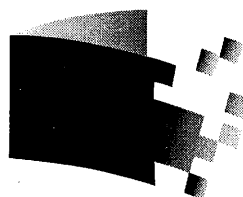


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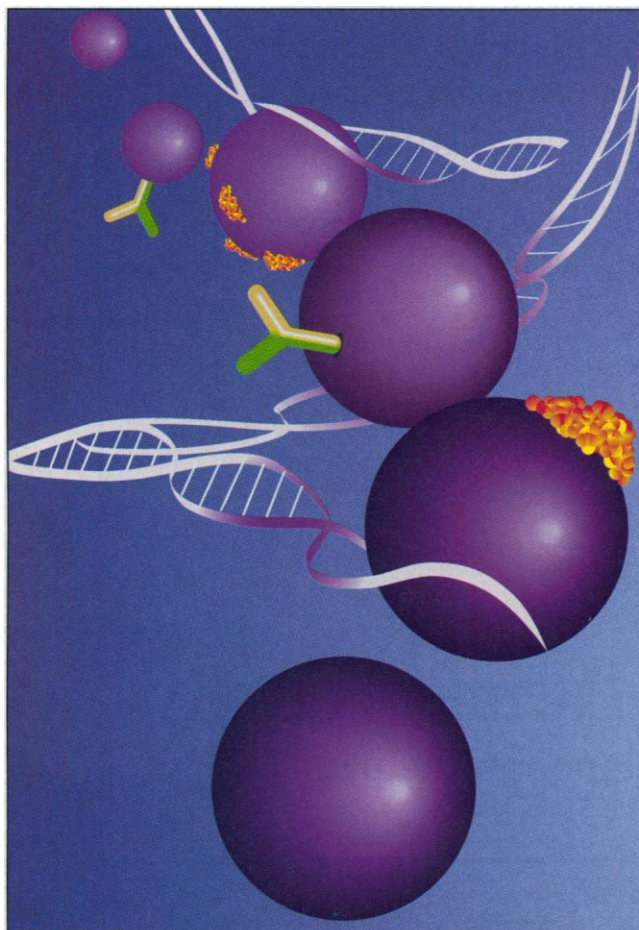
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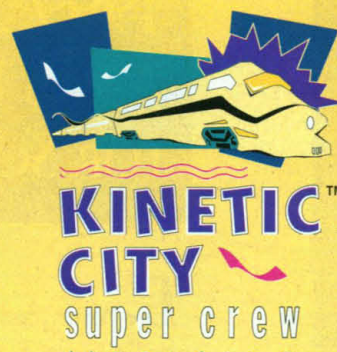
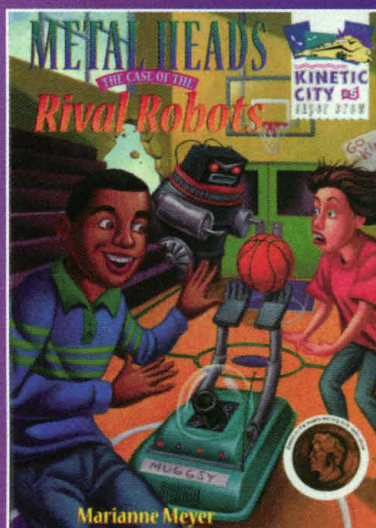
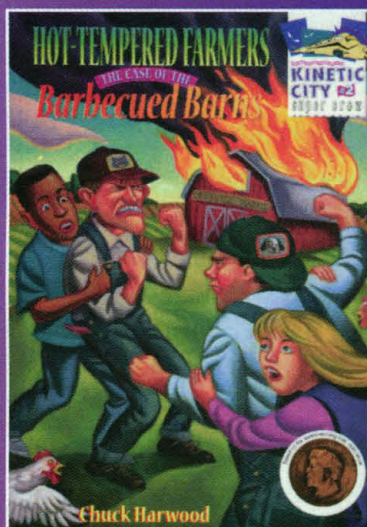
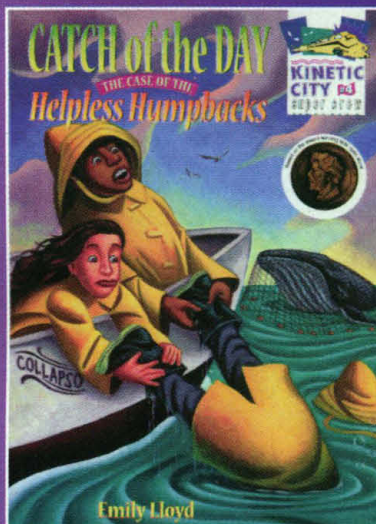
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The Bio-Imaging Analyzer Systems Neutron Detecting Imaging Plates are composed of a layer of gadolinium oxide and a photo-stimulable phosphor sandwiched between a flexible substrate and a protective coating. Images are recorded when neutrons stimulate the gadolinium oxide, initiating secondary radiation that is stored in the photo-stimulable phosphors. The imaging plate is then exposed to a scanning laser beam that extracts the image data as light. The imaging plates are reusable without the use of chemicals or darkroom. Because of the high sensitivity of the plates, irradiation time with neutrons can be reduced to one-hundredth that of traditional x-ray film. The plates are linear over five or

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## INSTRUMENTATION, APPARATUS, AND LABORATORY MATERIALS

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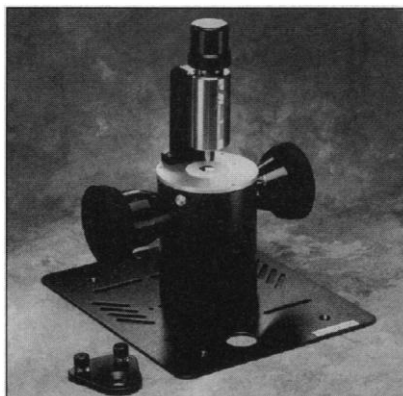
ders of magnitude, providing accuracy with high resolution never before attainable with neutrons. The versatility and ease of use broaden the scope of neutron-based research, including neutron crystallography, neutron radiography, and qualitative neutron nondestructive testing.

### HORIZONTAL ATTENUATED TOTAL REFLECTANCE ACCESSORY

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ATR crystal, which provides the short path-length that is helpful when analyzing highly absorbing materials such as carbon-filled or wet samples. A germanium crystal is especially useful for analyzing hard rigid polymers. The Thunderdome is completely purgeable, alignment free, and baseplate mounted for stability, making it useful for both qualitative and quantitative analyses.

### MICROPLATE SEALER

The ABgene Combi-Heat Sealer makes sealing microplates and polymerase chain reaction plates quick and easy. The sealer makes use of special foils, which have a layer of polypropylene or polystyrene bonded to one side. In 4 to 6 sec-

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onds, the sealer fuses the plastic layer of foil to the top of the plate. Thus, the contents of each well become completely encapsulated in either polystyrene or polypropylene. Heat sealing eliminates concerns of sample contamination from adhesive seals and sample loss due to evaporation.

### PROTEIN-RNA INTERACTIONS

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### LITERATURE

*Catalysis Technical Guide* focuses on the use of platinum group metals in both homogeneous and heterogeneous catalysis. The 62-page guide is designed to assist chemists in the design and selection of catalysts for specific applications, including hydrogenation, isomerisation, and hydroformylation. It includes a section on safe handling procedures for all the catalysts included in the guide.

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*Chromatography Products '98* is a 120-page catalog that details product information for Kimble autosampler vials and accessories and Kontes chromatography columns, high-performance liquid chromatography mobile phase systems, and thin-layer chromatography supplies and fittings. A vial selection guide and cross-reference listing offer a step-by-step method for identifying the insert, vial style, and vial volume for a particular model or type of autosampler.

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