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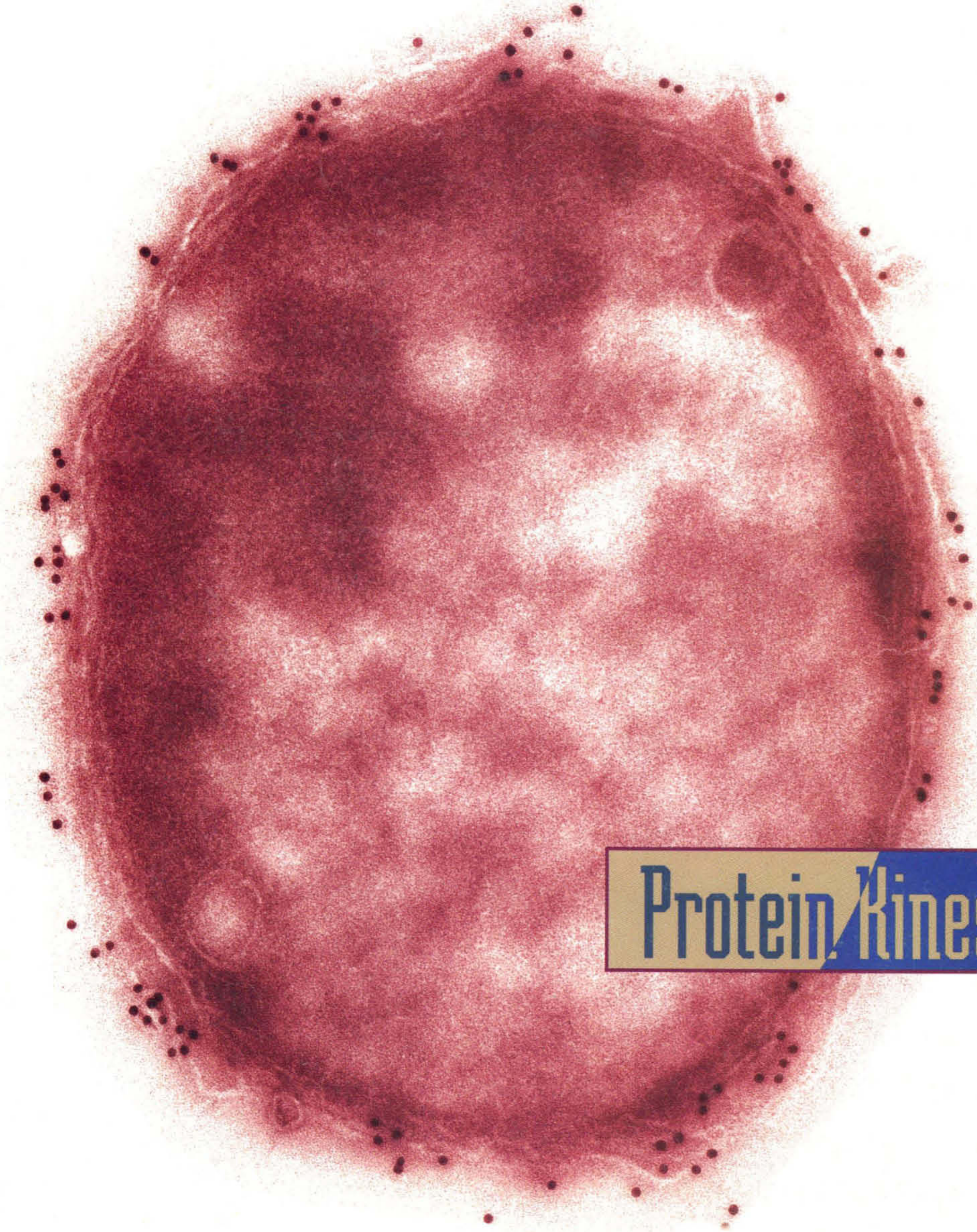
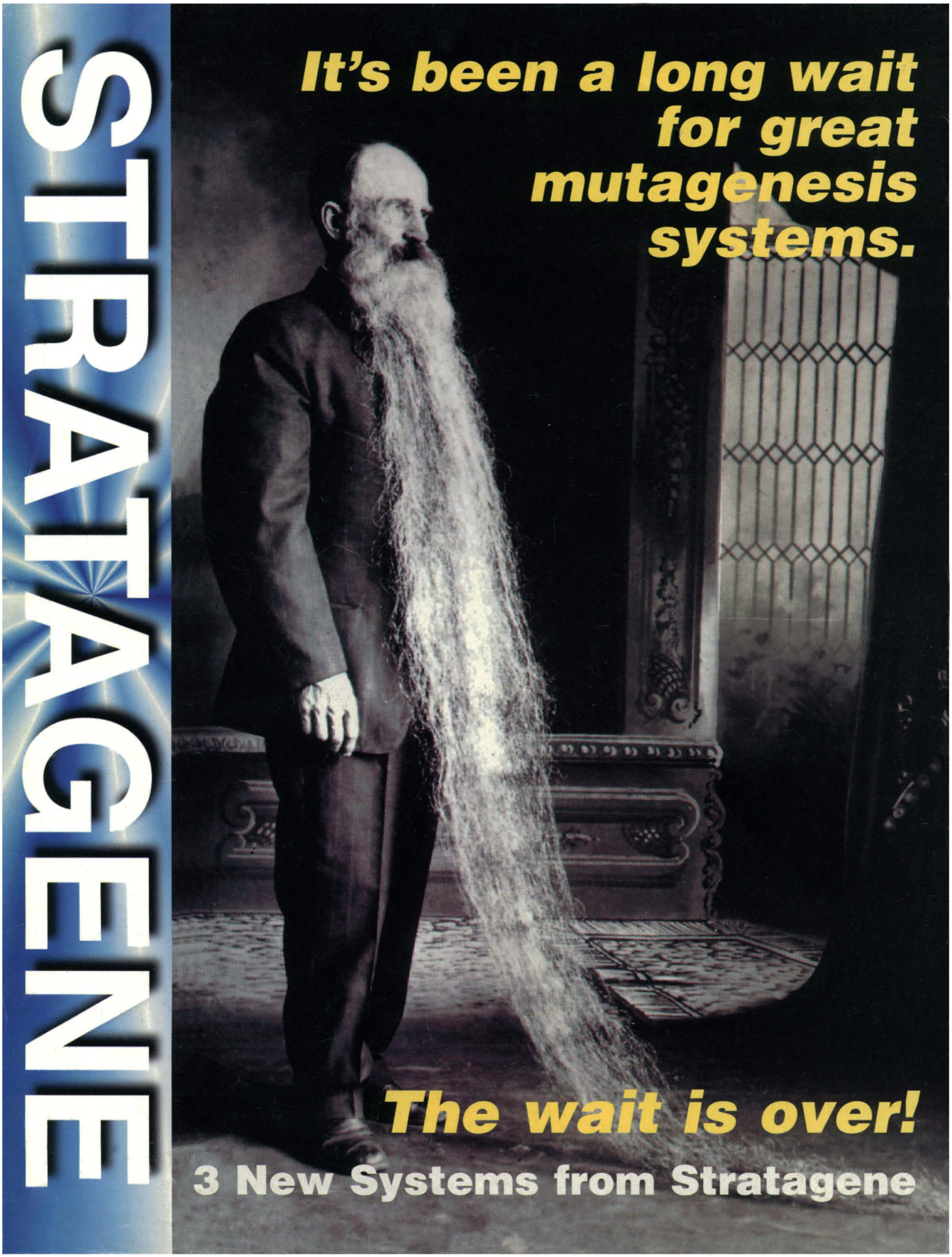


Protein Kinesis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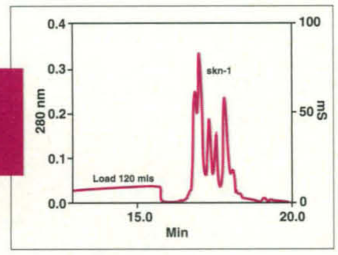
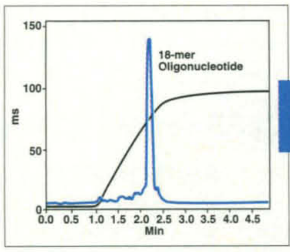


DO AN OLIGO PREP,



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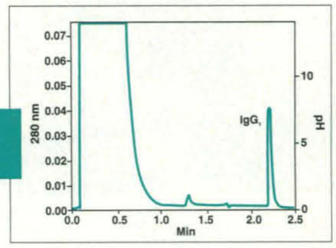
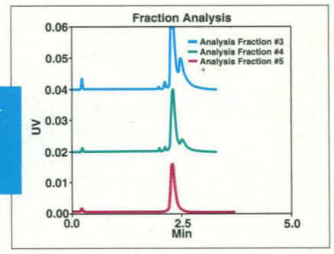


AND RUN SOME HIGH-RESOLUTION ANALYSES OF IGF-1 PEPTIDES.



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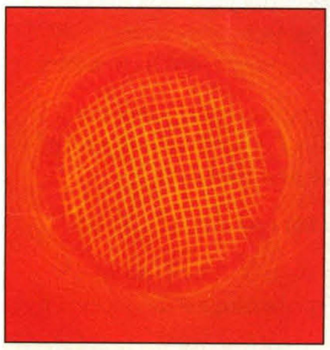
1486
Rough seas for oceanography

1560
Glow with the flow



NEWS & COMMENT

RESEARCH NEWS

PERSPECTIVES

ARTICLES

PROTEIN KINESIS

RESEARCH ARTICLES

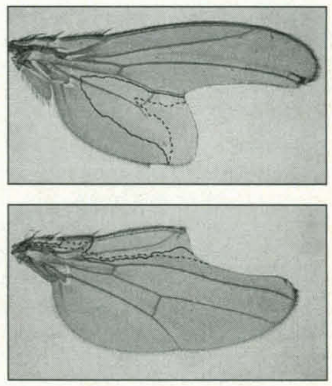
DEPARTMENTS

COVER

Cryosection of a yeast nucleus (long axis, 1.6 micrometers) immunolabeled to reveal the sites of the nuclear envelope that are associated with the coat protein coatomer. Antibodies to coatomer were applied to the section, then the bound antibodies were identified in a second step with the help of electron-dense gold particles that appear as tiny dots on the nuclear surface. See page 1526, the special section on Protein Kinesis beginning on page 1513, and the News story on page 1493. [R. Schekman and L. Orci]

REPORTS

TECHNICAL COMMENTS



1601
Winging it

Indicates accompanying feature

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THE MJ RESEARCH NOTEBOOK

Volume VI...No. 2 *A Bulletin of Technological Advance in Molecular Biology* *Spring 1996*

GOLD-PLATED SILVER *vs.* SAPPHIRE-ALUMINUM

Precious-Metal Block Is Speedy; Crystal-Encrusted Block Is Tough

The trusty PTC-100 cycler has long been available with two different blocks in the '96V' format to fit 0.2ml tubes or microplates. The extra-cost version is crafted of sterling silver that is gold plated, but the precious metals really offer just one advantage—high-speed ramping—though the 24k gold finish does look awfully good in the laboratory.

Gold-plated Silver Block

Silver is one of the best conductors of heat known—only diamond crystal is substantially better—yet silver has a relatively low thermal mass. Thus any quantity of heat pumped in or out of a silver block goes a long way, which results in speedier ramping rates when compared to other materials. The thick 24k gold plating is added to provide a tarnish-free finish.

The alternative material is a special alloy of aluminum, which is hard anodized to give a wear-free, corrosion-free finish. The aluminum conducts heat well, and these PTC-100s ramp at the relatively-rapid rate of up to 1.4°C/sec (the silver-gold blocks ramp at nearly twice this speed). The hard-anodized surface of the Al version is comprised of crystals of corundum, Al_2O_3, which also composes rubies and sapphires and which by definition is #9 on the Mohs hardness scale. So if you want a speedy PTC-100 for 0.2ml tubes or plates, you have a choice of two deluxe blocks—one with sporty gold plating, the other hard "sapphire" encrusting.

Improved Hot Bonnet™ Heated Lid Brings Pressure To Bear

The PTC-100HB™ Thermal Cycler

How the New Hot Bonnet Heated Lid Operates

Vessels are loaded into the cycler's block and the lid is latched closed. The thumbwheel is turned until the inner lid makes contact with the tops of the vessels, then one-half turn more. Subsequently, the lid can be opened and closed without re-adjustment until the vessel brand or vessel type is changed. This lid also works well with a variety of 96-well plates, particularly when used with Microseal 'A' sealing film.

FLEXIBLE NEW DESIGN FOR OIL-FREE CYCLING

Fits Most PTC-100 Thermal Cyclers; Can Be Retrofit

Heated-lid technology for thermal cyclers has advanced substantially since the earliest models were introduced in 1991. Heated lids were developed to allow thermal cycling of aqueous solutions in the bottoms of plastic vessels placed in a cycler's block—without having water vapor condense on the upper parts of the vessels which rise above the block. Condensation on the upper parts changes the concentration of reactants, which can inhibit reactions.

Most heated lid designs have long since tackled this condensation problem—with some designs proving superior, others not as good. A chief problem is that the vapor pressure of water at denaturation temperature (92°- 94°C) is sufficiently high to occasionally pop the tops of some vessels—particularly 0.5ml tubes and 96-well plates—which allows water to escape and spoils the reactions. Applying pressure to the tops of tubes to hold lids in place is tricky business, because different brands of tube differ in height, and excessive pressure (which some "wine press" lids can surely deliver) can craze or crack the vessels, leading to leakage.

Thus a new and improved Hot Bonnet heated lid was developed for PTC-100 thermal cyclers that is modeled upon the extremely successful design first introduced on the PTC-200 DNA Engine™. This lid incorporates a thumbwheel that adjusts the height of the heated lid, as well as the pressure that the lid applies to vessels. The working "envelope" of the lid is substantial, which allows different sorts of vessels to be accommodated in one machine, such as both 0.2ml tubes and varying designs of 96-well microplates in the two '96V' models.

These improved Hot Bonnets are available for PTC-100s holding 0.5ml tubes, 0.2ml tubes, 96-well and 192-well plates. Factory retrofits to existing PTC-100 machines are also available.

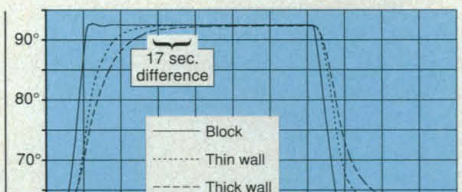
Thin-walled Tubes Do Make a Difference

Enhanced Equilibration Takes Advantage of Rapid Ramping Rates

Often investigators inquire of MJR staff whether thin-walled tubes really make a difference in experimental protocols. Yes, they do—particularly in cyclers that ramp rapidly.

Back in the olden days, when most thermal cyclers ramped at rates well below 1°C/sec, the thickness of the tube wall was less important. So much time was spent in ramping that the reaction mixture would already be near target temperature when the block reached target.

However, many modern instruments—such as the MJ RESEARCH DNA Engine—can ramp at far faster speeds, like 2-3°C/sec. The rapid



Temperature of 50µl samples of water in 0.5ml tubes in a MJR DNA Engine™ using block control

equilibration provided by thin-walled tubes helps take advantage of this speed by allowing shortened incubations. In the example shown above, over 30 seconds per cycle can be saved, for an overall savings of 15 minutes in a 30-cycle run—just by using the improved tubes.

Rugged thin-walled tubes are available from MJ RESEARCH, in both 0.5ml and 0.2ml sizes.

PCR is covered by patents owned by Hoffmann-La Roche, Inc. & F. Hoffmann-La Roche Ltd. Users should obtain license to perform the reaction.

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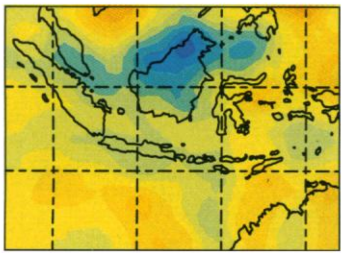
THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Diving into the mantle

The complicated, earthquake-prone, four-plate collision-subduction zone of Indonesia represents one of the more intriguing locations where a well-resolved image of the subducting slab would improve our understanding of plate collisions and mantle convection. Widiyantoro and van der Hilst (p. 1566) used global and regional *P* waves from the abundant earthquake record, along with other *P*-wave phases that sample slightly different pathways in the mantle, to perform a linear tomographic inverse and to image the slab



beneath Sumatra. They infer that the slab penetrates into the lower mantle, to at least 1200 kilometers, and that the subducting plate may be detached because of the rotation of Sumatra in the Early Tertiary.

■

Modeling meteoritic origins

Chondrites are a type of meteorite containing small spherical objects known as chondrules and other particles thought to have formed early in the solar nebula. They are key evidence for determining the composition and early evolution of the solar system and planets. The exact origin of the chondrites has been uncertain—one problem is that they seem to have attained high temperatures (2000 kelvin or greater) for a brief period (about 1 hour). Shu *et al.* (p. 1545) propose through a series of numerical calculations that the chondrules and other particles formed as a result of aerodynamic drag in wind near an early sun. In addition to the thermal history, their model addresses the various sizes and types of particles seen in chondrites.

Quick conversions

Light alkanes, such as those found in natural gas, can be increased in value by converting them to other products, but they are difficult to partially activate—they tend to either not react at all, or, once activated, go to undesirable products, such as CO_2 and water. Goetsch and Schmidt (p. 1560) have found a simple route that partially oxidizes ethane, propane, and *n*-butane to form oxygenates and olefins. They passed alkane-oxygen mixtures over a platinum wire gauze catalyst, which led to rapid chemical heating (about 5 microseconds) and subsequent quenching (about 200 microseconds). These rapid conversions help prevent complete oxidation.

■

Getting iron across

Iron must cross cell membranes in order to be incorporated into the active sites of many essential enzymes. The mechanism by which iron actually crosses a lipid bilayer has remained elusive for many years. Stearman *et al.* (p. 1552; see the Perspective from Kaplan and O'Halloran, p. 1510) characterize a pair of proteins that form an iron-transport complex in the plasma membrane of yeast cells. Mammalian homologs likely to be important in health and disease can now be identified.

■

Cocaine cravings

Withdrawal from cocaine addiction is often characterized by cravings for the drug that resemble the "high" cocaine itself induces. The major site of cocaine reinforcement in the brain is the mesolimbic dopamine system, in which dopamine acts at two kinds of sites, the D_1- and D_2-like receptors. Self *et al.* (p. 1586; see the news story by O'Brien, p. 1499) studied cocaine-seeking behavior in rats and found that relapse of cocaine use was triggered by activation of the D_2-like receptors, but that activation of the D_1-like receptors blocked cocaine-seeking behavior. This result suggests that D_1-like receptor agonists may be useful for avoiding relapse in the treatment of cocaine addiction.

■

Chemistry of V(D)J recombination

A huge number of antigen-recognition possibilities are generated by recombining the limited number of variable (V), diversity (D), and joining (J) gene segments of the germline T cell receptor and immunoglobulin genes. In their report, van Gent *et al.* (p. 1592; see the Perspective by Craig, p. 1512) show that the chemical mechanism of V(D)J recombination has a stunning similarity with the transposition mechanisms used by retroviral integrases to move bacterial DNA segment. They found that reaction proceeds through direct trans-esterification. In the case of V(D)J recombination, the cleavage reaction is catalyzed by RAG1 and RAG2 proteins, resulting in the formation of hairpin structures; a further source of receptor diversity is provided by the subsequent imprecise processing of these structures.

■

Anchors array

Precise control and coordination of biochemical signaling pathways within cells requires localization of some components to particular sites. Klauck *et al.* (p. 1589) describe the organization of signaling molecules at specific synaptic regions where neurons receive signals from other cells. The A kinase anchoring protein serves as a scaffold that anchors not only the adenosine 3′,5′-monophosphate–dependent protein kinase (PKA or A kinase) and phosphatase 2B (calcineurin), but also protein kinase C. This array presumably allows the enzymes to be promptly regulated by signals received at the synapse and to have immediate access to appropriate substrates.

■

Winging it

During wing development in *Drosophila*, cells along the anterior-posterior (AP) compartment boundary interact with cells along the dorsal-ventral (DV) compartment pathway to promote development along the proximal-distal axis. The establishment of the AP and DV axes is regulated by signal transduction pathways involving two genes, *decapentaplegic* (*dpp*), a transforming growth factor–β homolog, and *wingless* (*wg*), a secreted glycoprotein. Grimm and Pflugfelder (p. 1601) have examined the role of *optomotor-blind* (*omb*) in wing formation and found that *omb* is required for distal wing development and responds to both *wg* and *dpp* signalling.

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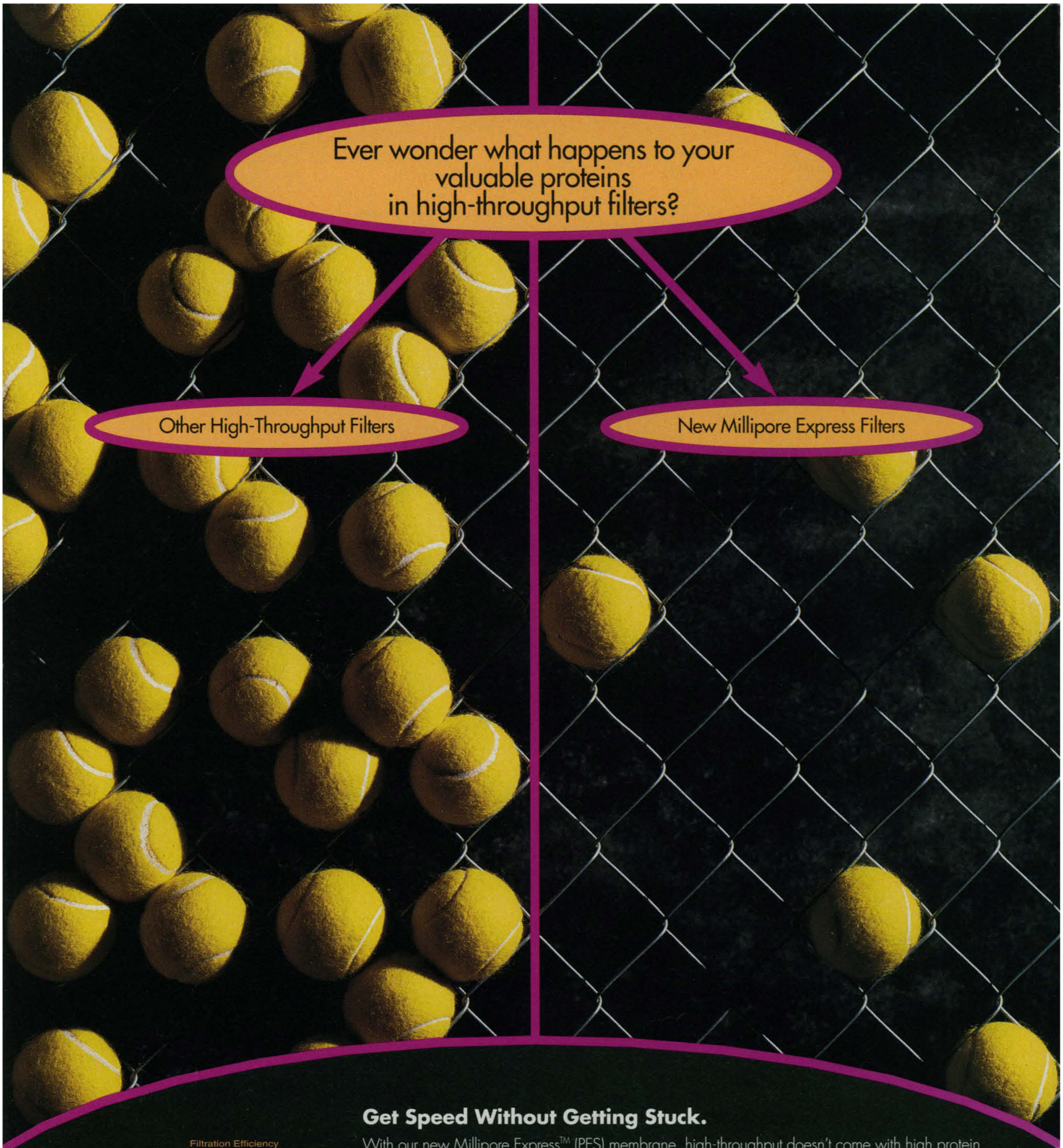

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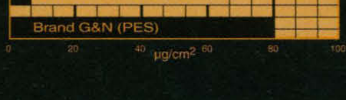

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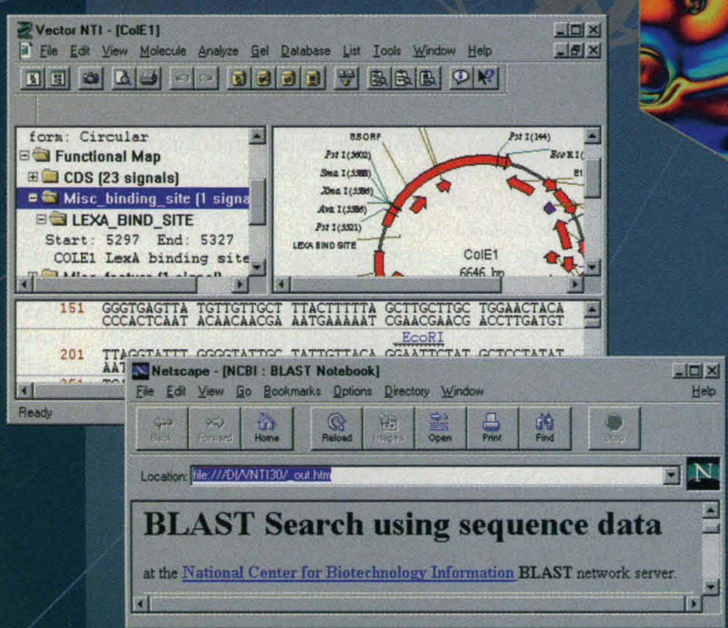

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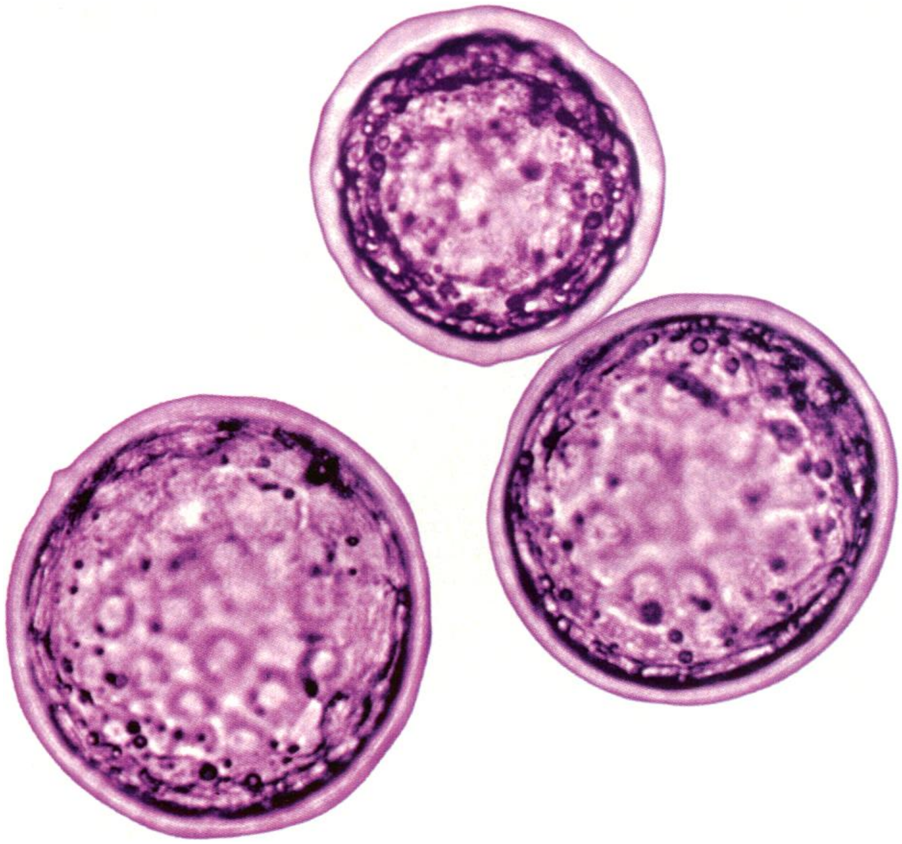

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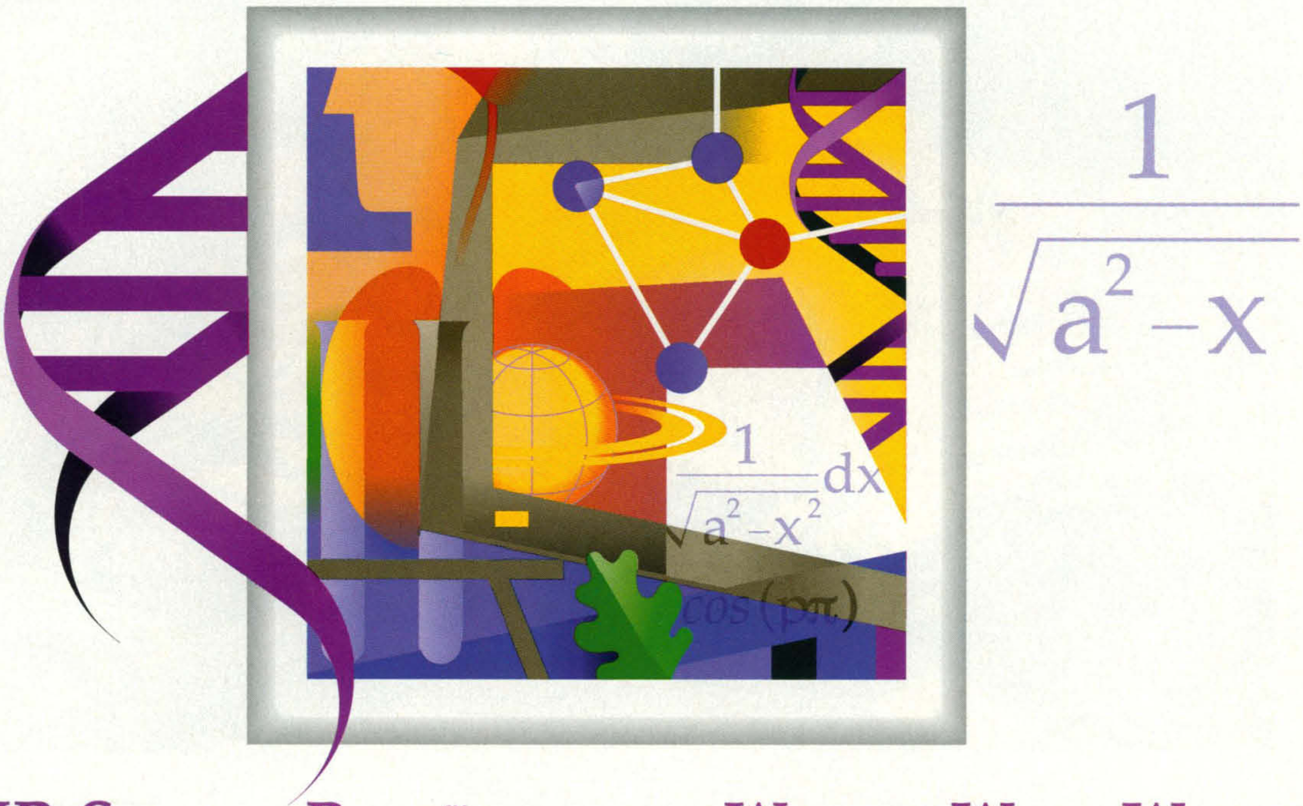

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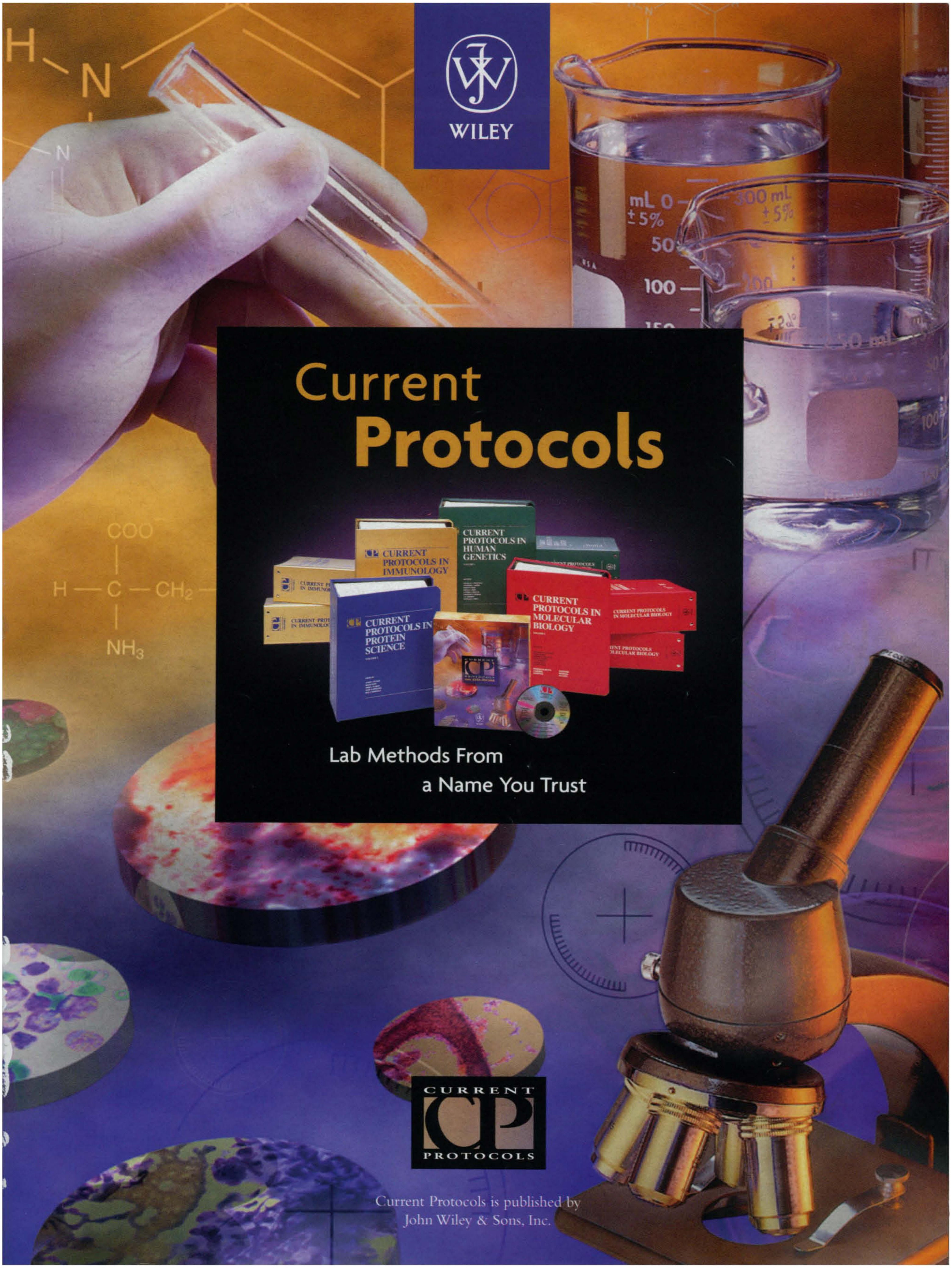
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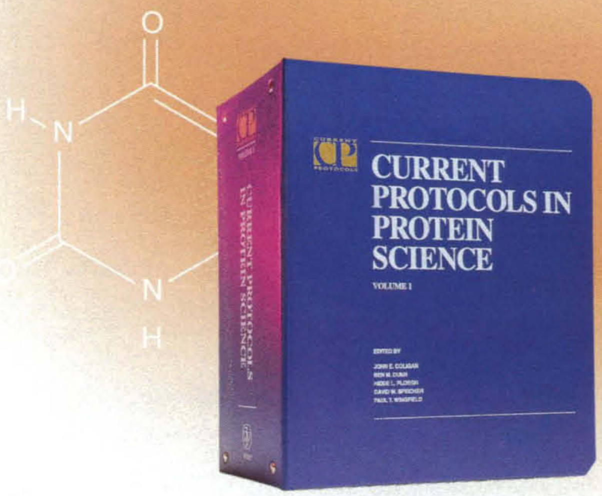

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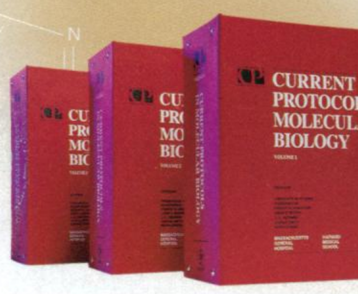

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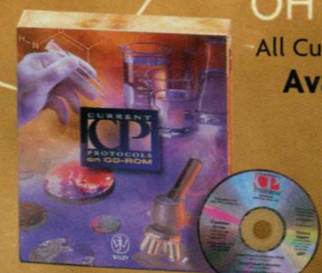

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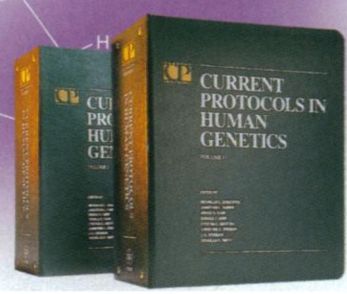

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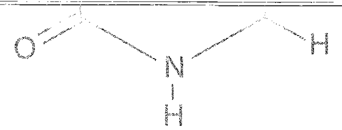

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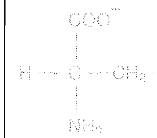

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