



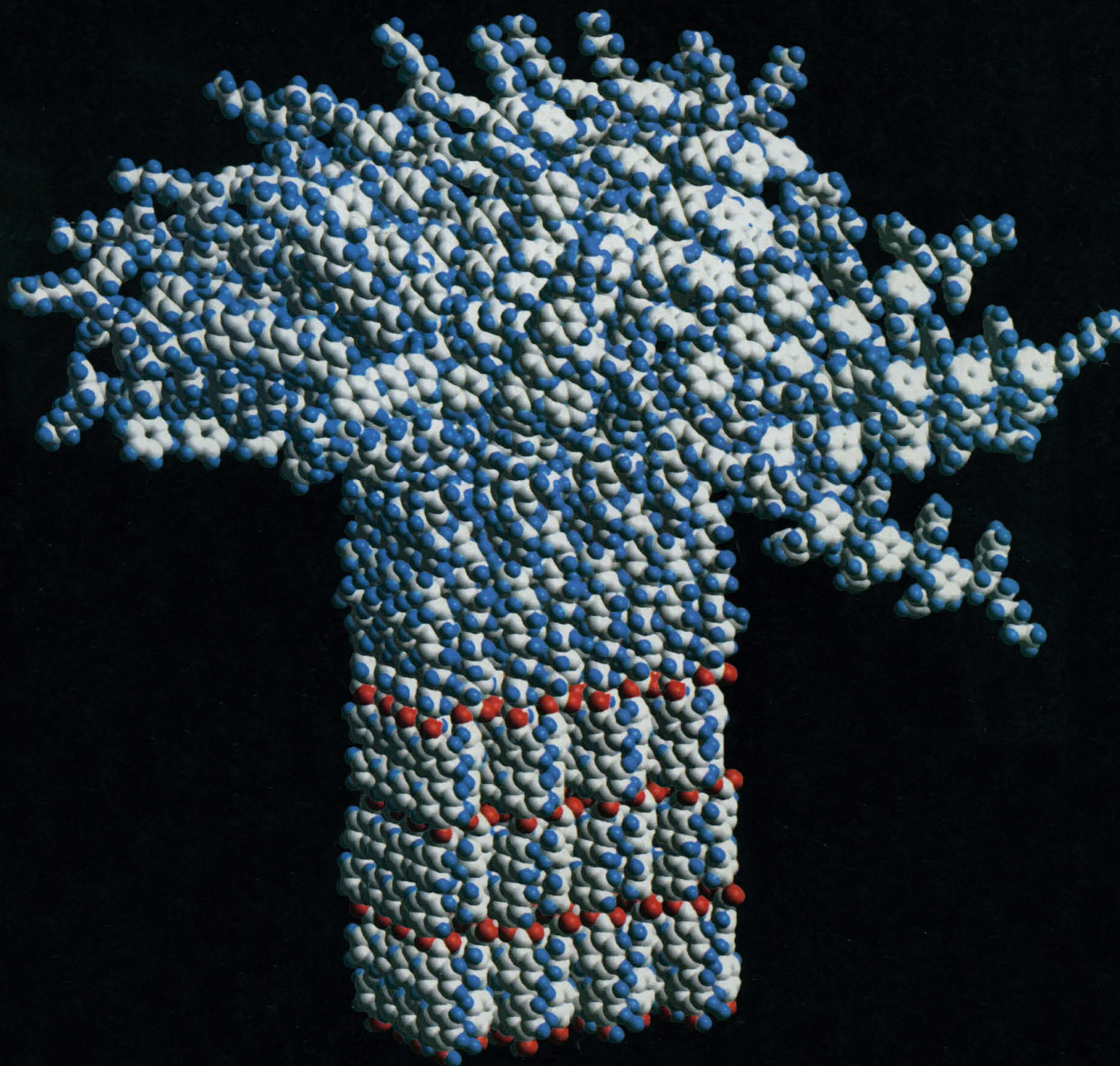
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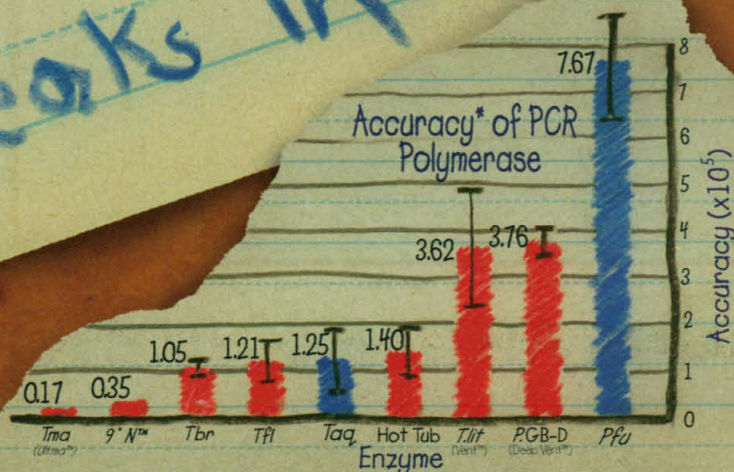
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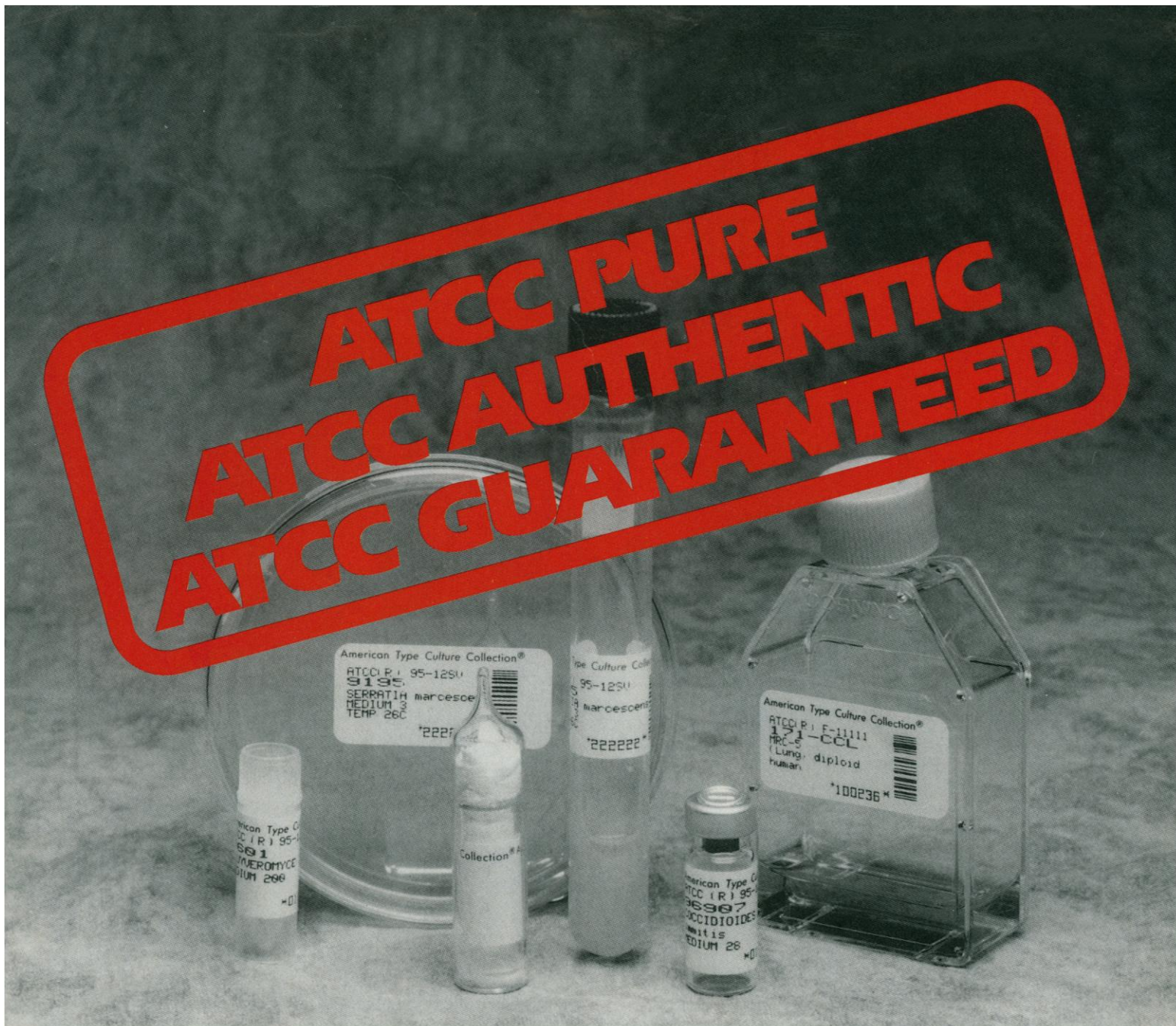
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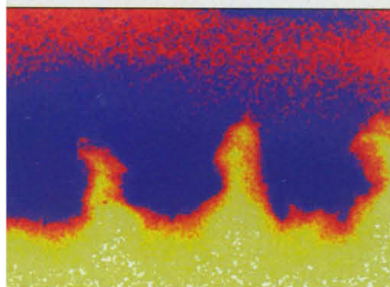
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The genetics of resistant mosquitoes

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COVER

Mushroom-shaped supramolecular unit formed by the ordered aggregation of miniature triblock copolymers. These mushroom nanometer-size structures can self-organize into macroscopic polar materials with many interesting properties. The formation of the units is be-

lieved to be mediated by attractive and repulsive forces among different blocks of the miniaturized polymers. It is not currently known what drives the macroscopic organization of these supramolecular materials. See page 384 and the News story on page 354. [Image: Aaron Amstutz]



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Montserrat rumbles

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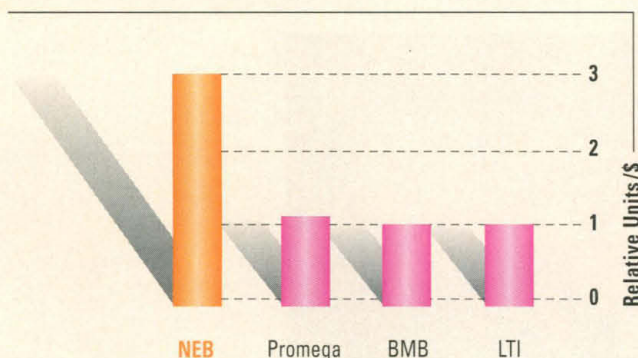
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Polar organic films

In a membrane bilayer, the two lipid layers are arranged "tail to tail"; both sides are hydrophilic, and any inherent molecular polarity, such as a dipole moment, is canceled by another molecule in the opposing layer. Stupp *et al.* (p. 384; see the cover and the news story by Service, p. 354) have formed organic films that arrange in an inherently polar fashion, that is, heads to tails, so that one side is hydrophobic and the other hydrophilic. Relatively short triblock copolymers self-assemble into 200-kilodalton nanostructures, which then aggregate into layers to form the films. The films are highly adherent to their substrates, and their inherent polarity leads to second-order nonlinear optical activity despite lacking strong chromophores.

Comets and shock chemistry

Comets may have provided Earth and other planets with organic molecules directly, but the high-shock temperatures of an impact may have also helped synthesize additional molecules in primitive planetary atmospheres. McKay and Borucki (p. 390) simulated shock heating of an atmosphere with an overall cometary composition. Their results imply that organic molecules could be produced by shock heating of a methane-rich atmosphere but would not form in one rich in carbon dioxide.

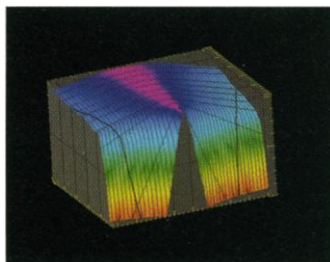
Cold but moving

Strontium titanate (SrTiO_3) is one of the most studied materials in solid-state physics, and

Immunoglobulins and membrane expression

Immunoglobulins (Igs) exist in both secretory and membrane-bound forms. The functions served by the latter forms are revealed in three reports (see the Perspective by Tarlington, p. 374). Targeted disruption of the transmembrane domain was performed by Kaisho *et al.* (p. 412), who used IgG1 and by Achatz *et al.* (p. 409), who used IgE, to show that production of antigen-specific secretory IgG1 and IgE is strictly dependent on prior surface expression of the membrane-bound form. Truncation of the highly conserved cytoplasmic domains of IgG1 and IgE, which allowed membrane expression of the molecules with a minimal cytoplasmic tail, resulted in substantial but incomplete reduction in serum and antigen-specific Ig. Weiser *et al.* (p. 407) show that the longer tail contains an endosomal targeting motif: Antigen bound to membrane Ig is shuttled to the endosomal compartment, where it may be processed for subsequent presentation to T cells. These new results are consistent with the dependence of IgG1 and IgE responses on help from T cells.

Grupp and Goldman (p. 392) have added another phenomenon to its repertoire—it shows large piezoelectric effects at



temperatures below 10 kelvin, apparently because of a quantum critical point at zero temperature. The effect is large in a temperature range where other low-temperature piezoelectrics show a diminished response, and it may find use in ultralow-temperature thermometry and scanning probe microscopy.

Ancient ape ancestor

Fossils were discovered in the early 1960s from Moroto in Uganda that may represent an ancient common ancestor to apes and humans, but their age and interpretation have been

controversial. Gebo *et al.* (p. 401; see the news story by Gibbons, p. 355) present argon-40–argon-39 dates on a younger basalt flow which indicate that the Moroto fossils are at least 20.6 million years old. Evidence from newer fossil samples they collected, together with the old fossils, imply that the ape-like body plan had already developed by this time.

Gaining stability

Some high-energy solid phases, such as diamond, may persist at ambient conditions if the energy barrier to form the lower energy structure is too high to be overcome at low temperature and pressure, but many others spontaneously transform upon the release of pressure or the lowering of temperature. Chen *et al.* (p. 398; see the Perspective by Brus, p. 373) investigated the kinetics of phase transformations in nanocrystals as a function of crystallite size. They show that metastable phases persist to lower tempera-

tures and pressures than in the bulk phases, indicating that nanocrystals may provide a route to the synthesis and stabilization of high-energy structures of materials.

Treating the effect of genetic disease

Several diseases, including Tay-Sachs and Gaucher's disease, are associated with defects in the pathway of glycosphingolipid breakdown in lysosomes. One strategy for treating these diseases, regardless of the particular genetic defect involved, would be to block the production of glycosphingolipids. In a mouse model of Tay-Sachs disease, Platt *et al.* (p. 428) showed that treatment with *N*-butyldeoxynojirimycin inhibited glycosphingolipid synthesis and prevented abnormal accumulation in the brain.

Inside an isomerase

Numerous biological reactions, enzymes involve the cleavage of a carbon-hydrogen bond that is next to a carbonyl (CO) group or a carboxyl (COOH) group to form an enol or enolate intermediate, which may in turn be protonated at the same or an adjacent carbon atom. A paradigm for this class of compounds is 3-oxo- Δ^5 -steroid isomerase. The solution structure was determined by Wu *et al.* (p. 415) using multidimensional heteronuclear magnetic resonance spectroscopy. From this structure and additional kinetics and mutagenesis studies, they suggest that the dienolate is stabilized by two hydrogen bonds, rather than by a low-barrier hydrogen bond as had been suggested previously.



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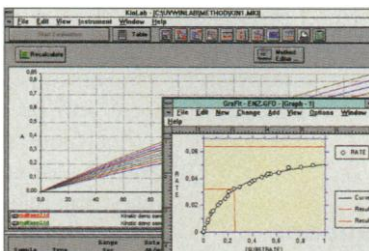
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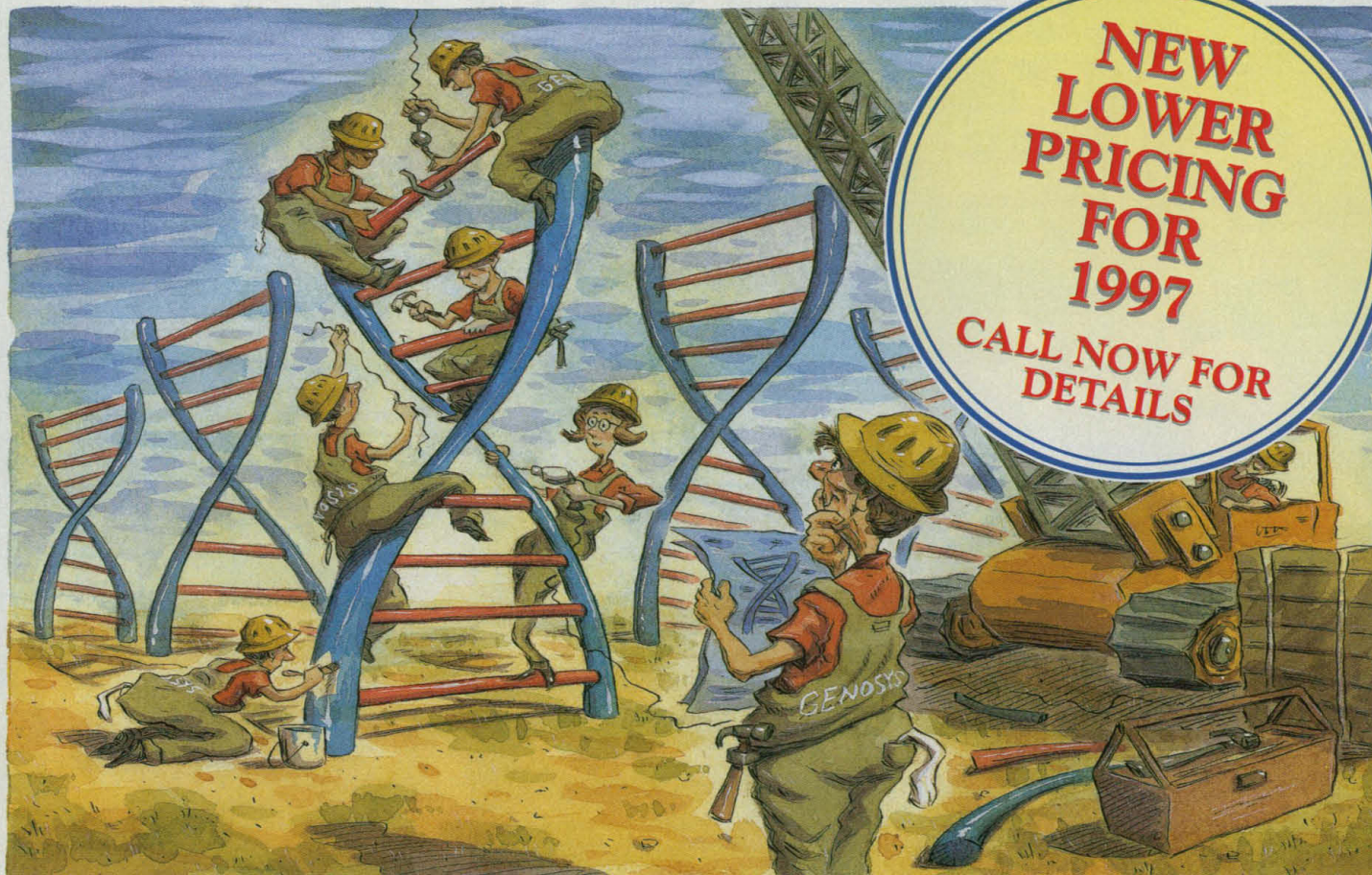
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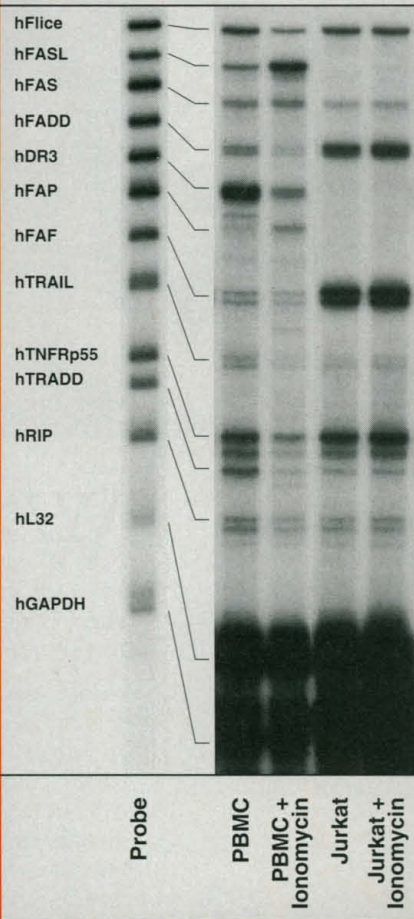
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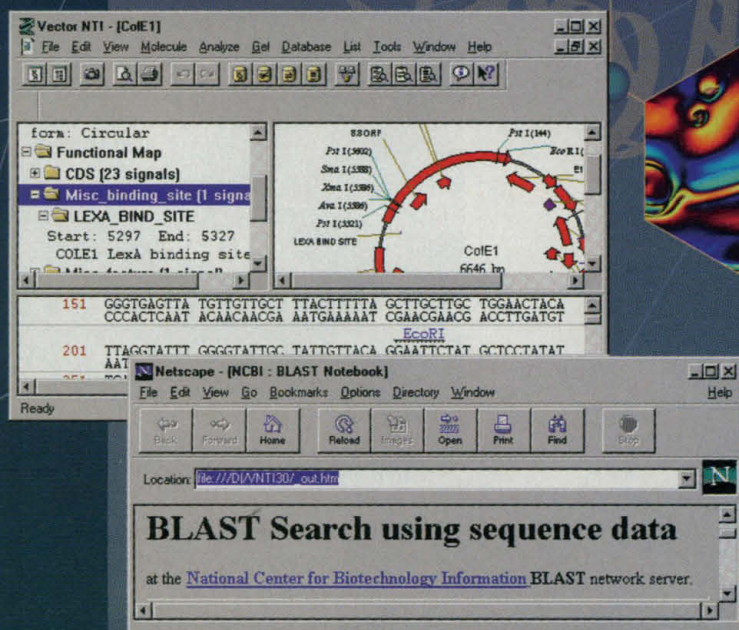
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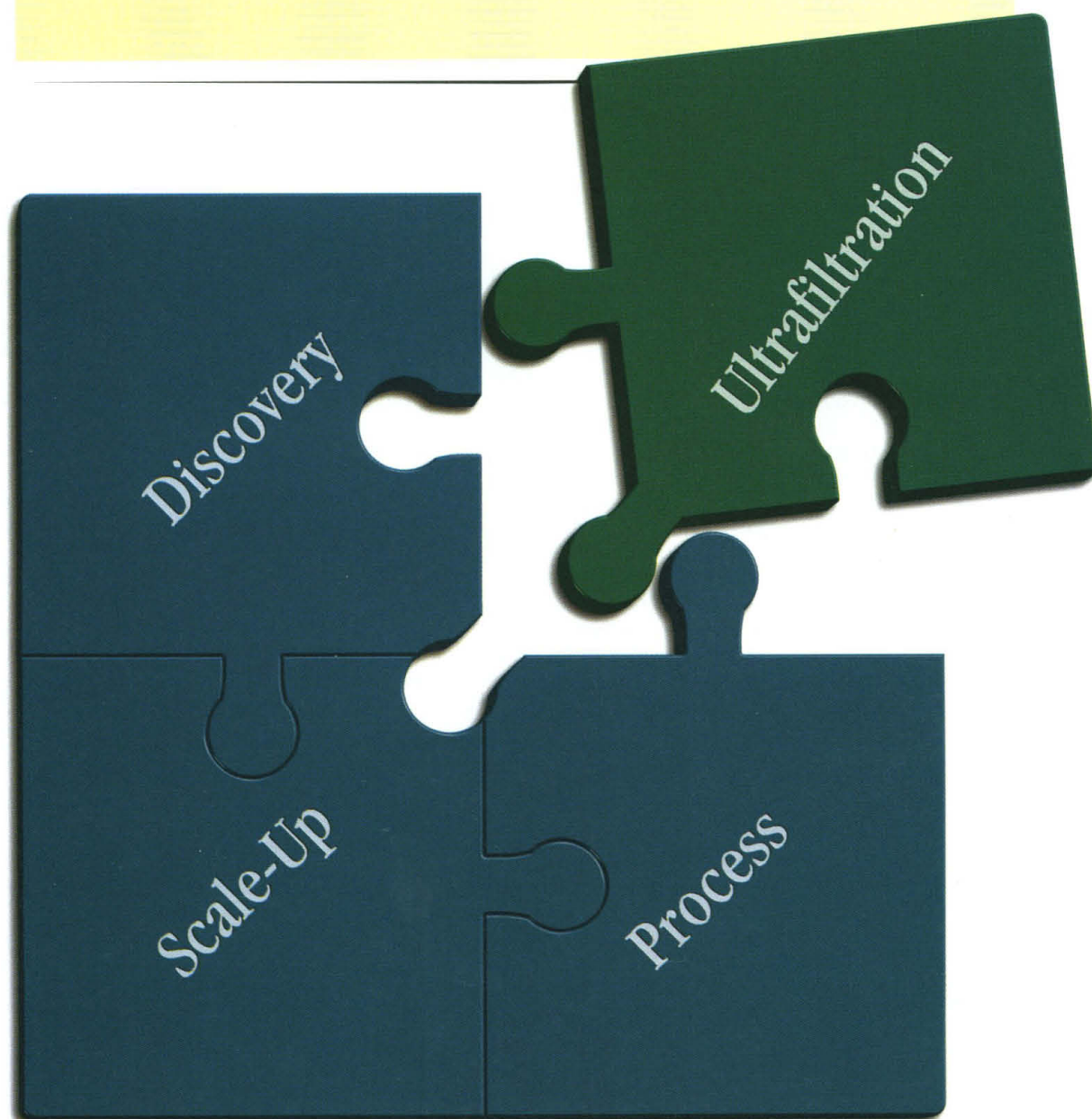
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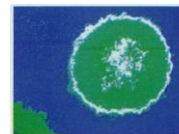
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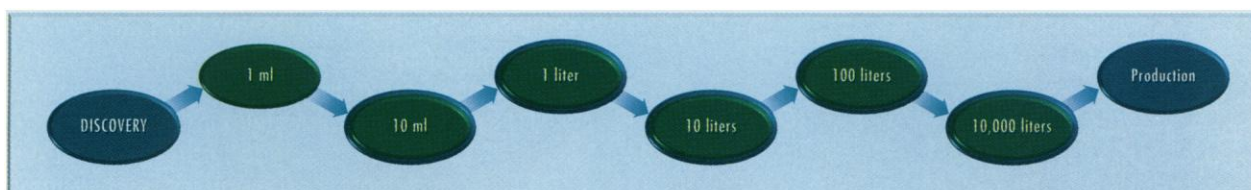
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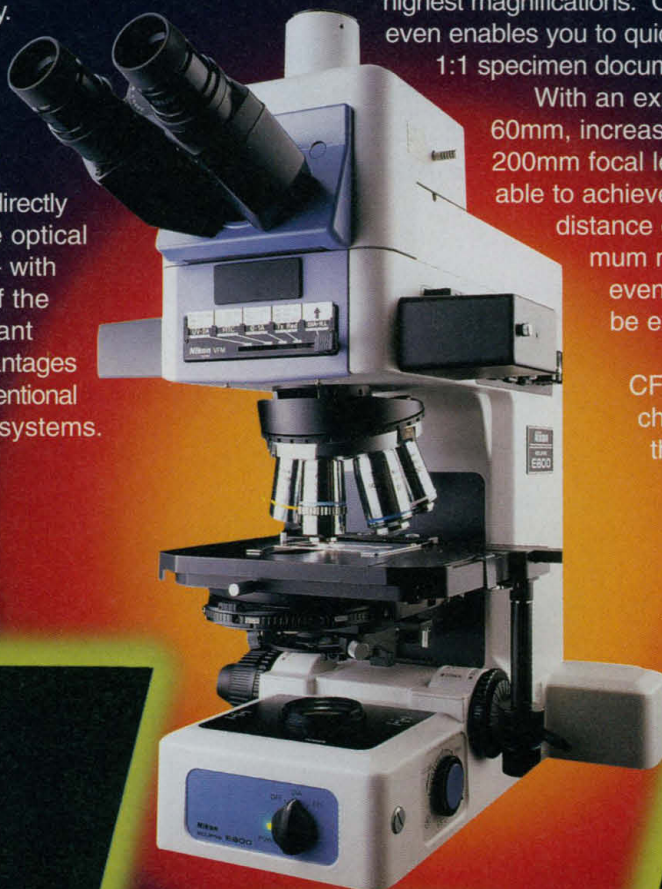
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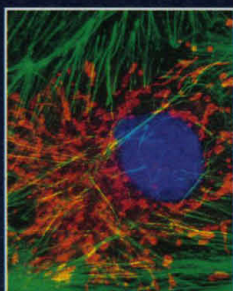
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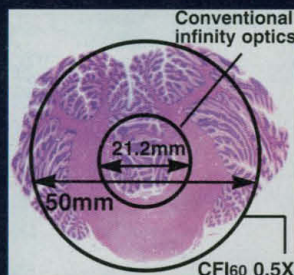
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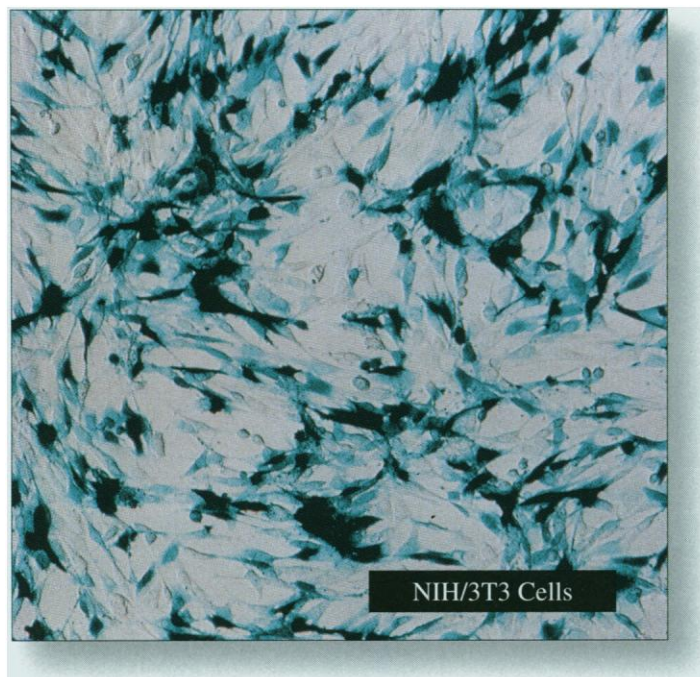
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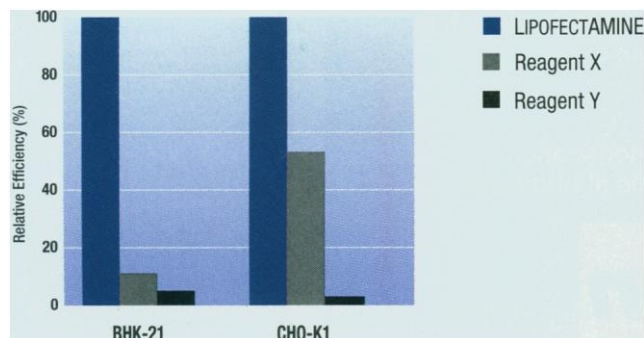


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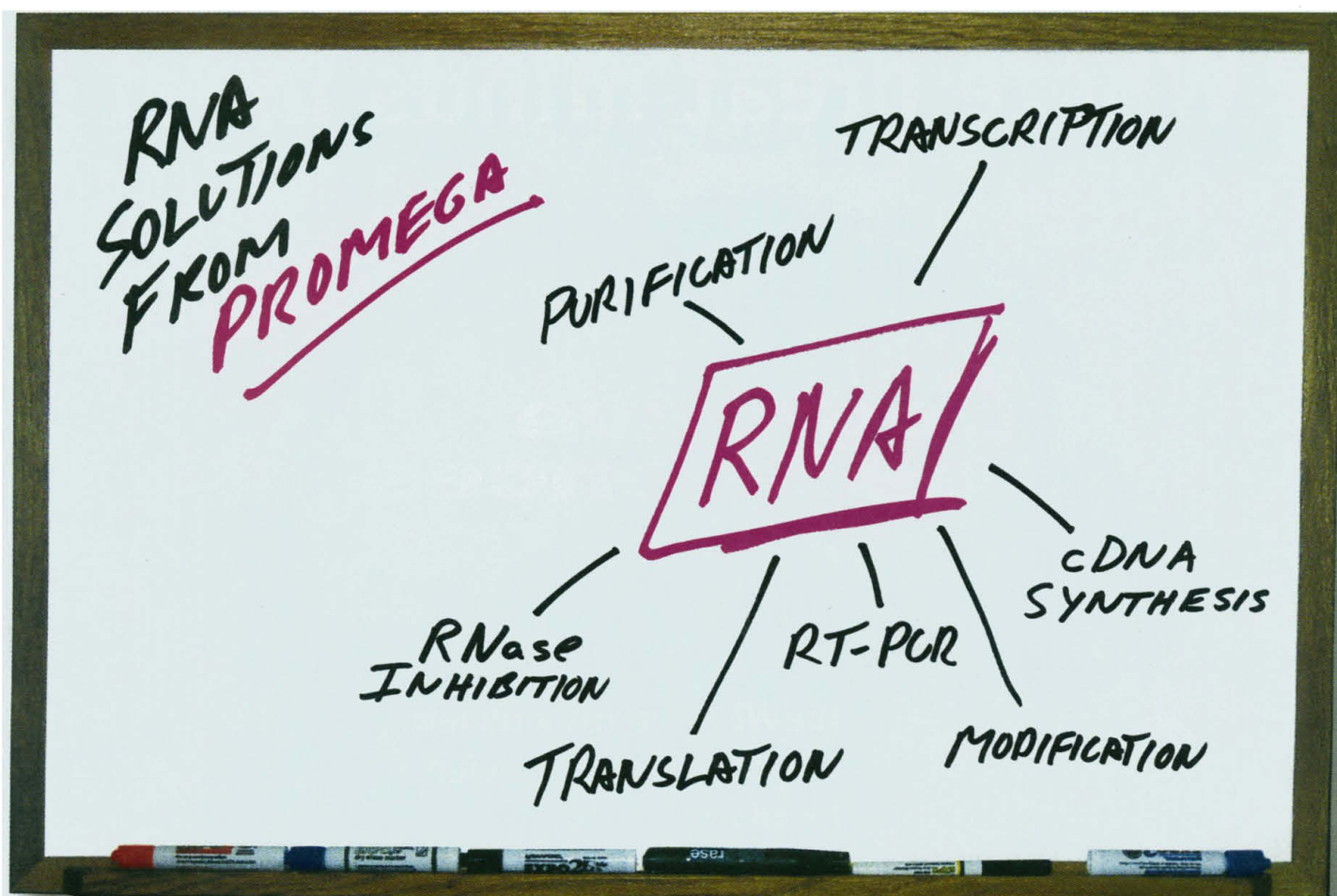
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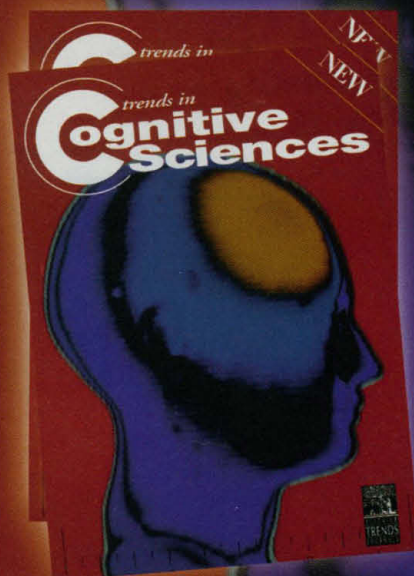
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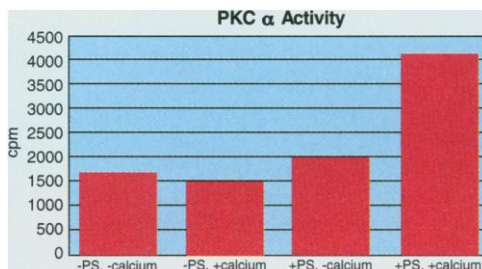
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