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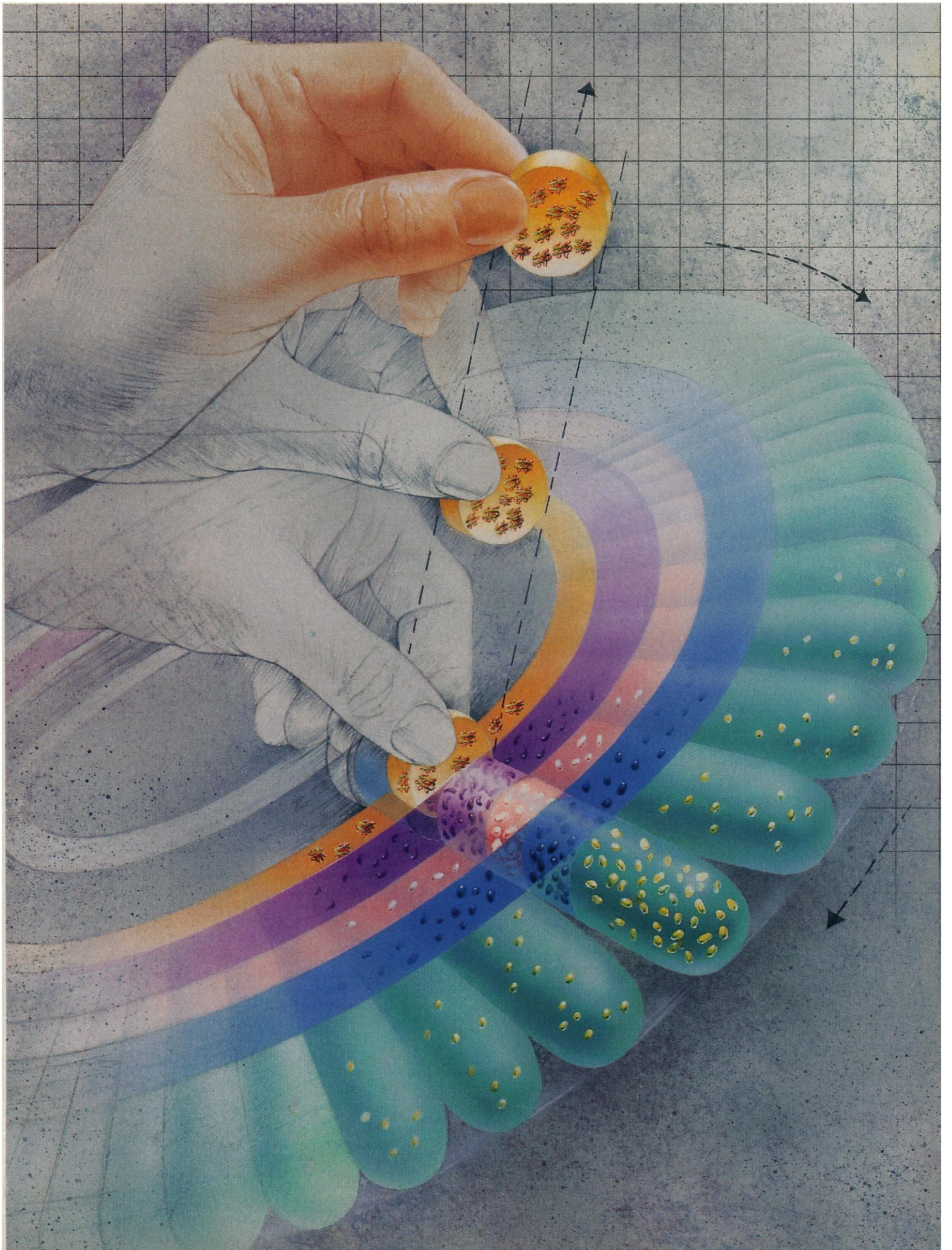
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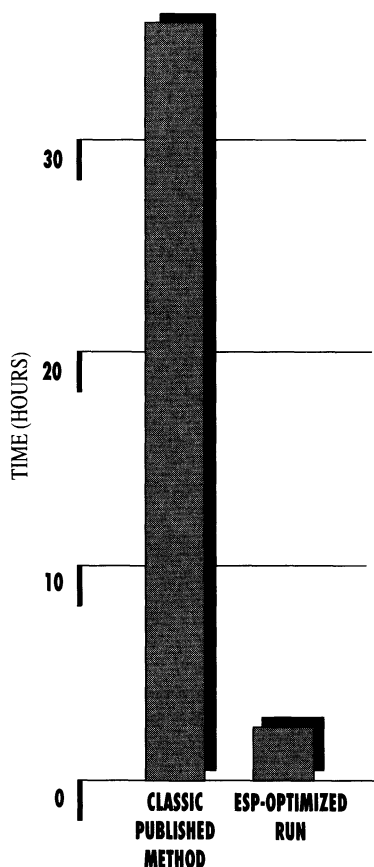
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Peace roils the
weapons labs

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COVER

Scanning tunneling microscope (STM) image of a quantum corral. The 48 iron atoms (blue peaks) forming the corral (diameter, 143 angstroms) were arranged on a copper surface with the tip of the STM. The circular oscillations reveal the density distribution of electrons occupying quantum states of the corral. Corrals shape

the spatial distribution of surface state electrons so that the properties of electrons in reduced-dimension systems can be studied. See page 218, the News story on page 178, and the Perspective on page 195. [Image: IBM Research Division]



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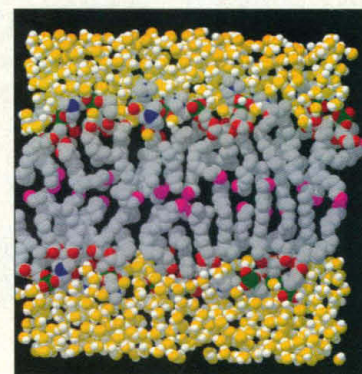
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The ins and outs of trotting

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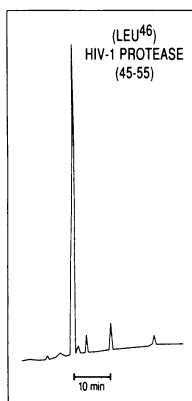
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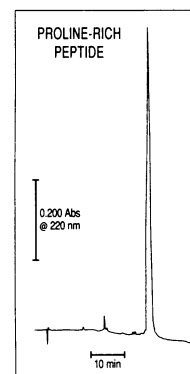
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HPLC data for a crude, proline-rich 21-residue peptide, synthesized using feedback control.

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THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Close to the edge

Since their final planetary encounters, Voyagers 1 and 2 have been heading toward the heliopause, where the solar wind runs into the interstellar medium. They have not arrived there yet, but in July last year both spacecraft detected an unusual burst of radio emission, which Gurnett *et al.* (p. 199) argue was initiated at the heliopause by an interplanetary shock wave generated by intense solar activity in the middle of 1991. They deduce that the heliopause is between 116 and 177 astronomical units from the sun.

Designed Diels-Alder catalysts

Chemists use the Diels-Alder reaction to create rings from molecules with double bonds; the products formed usually adopt one particular stereochemical arrangement. Gouverneur *et al.* (p. 204) have developed sets of catalytic antibodies that can catalyze the formation of either the normally favored *endo* product or, remarkably, the disfavored *exo* product. Binding energy is used to reroute the reaction along the higher energy *exo* pathway.

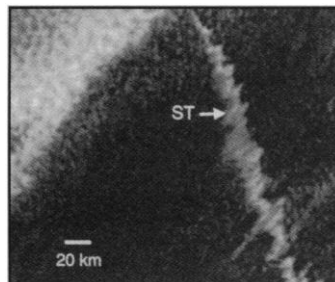
A stellar corona

Many stars are bright at x-ray wavelengths, and the emission is attributed to a corona of hot gas such as the sun shows during total eclipse. The eclipsing binary star α Coronae Borealis consists of a sun-like star and an x-ray-dark companion. By correlating the x-ray brightness of the system with the orbital phase, Schmitt *et al.* (p. 215) were able to construct a crude map of the star's corona. Their observations, obtained with the

ROSAT satellite, show that this corona, like the sun's, is highly asymmetric; most of the emission, they suggest, comes from a localized complex of magnetic field loops.

Cloud collapse

The behavior of clouds is one of the major unknowns in predicting climate changes resulting from anthropogenic emission of CO₂ and other gases. Ship's tracks have provided evidence that emissions of small particles



decrease droplet size and drizzle in clouds and thus increase the cloud's albedo. This feedback enhances the cooling effects of pollutants. Ackerman *et al.* (p. 226) propose, however, that collision of droplets internal to the clouds may limit their lifetime as emissions wane. Numerical simulations suggest that typical times for clouds to decay to a low fog with significantly lower albedo is several days.

Rounding up electrons into quantum corrals

One of the simplest quantum-mechanical systems is the "particle-in-a-box." Crommie *et al.* (p. 218; see cover) have studied the behavior of electrons inside a round, two-dimensional box that they constructed by manipulating iron atoms on a smooth copper surface with the scanning tunneling microscope (STM). Forty-eight iron atoms were arranged to form a "quantum corral" with a radius of 71 angstroms. Measurements with STM at 4 kelvin showed that the distribution of surface electron states within the corral matched that expected for an electron confined by the iron atom barrier. Reed (p. 195) discusses these results in a Perspective, and Amato (p. 178) highlights some new STM applications.

Kernel differences

Modern-day maize may have evolved through the domestication by early agriculturalists from teosinte, a wild grass. However, teosinte and maize ears differ significantly, in that the teosinte ear carries many fewer kernels that are enclosed by hardened fruitcases that make harvesting difficult. Dorweiler *et al.* (p. 233) show that the *Tgal* gene, which regulates the structure of the fruitcase, alone accounts for a large part of the difference between teosinte and maize. The maize version of *Tgal* leaves the kernel more accessible to harvest.

Heavy breathing

Many people are most aware of breathing during exertion, such as running. Bramble and Jenkins (p. 235; see Perspective by Alexander, p. 196) show that the dynamics of breathing in trotting dogs is more complex than had been previously supposed. They determined the displacements of the diaphragm and viscera in a trotting yellow labrador and compared them to the phasic patterns of respiration and locomotion. Their analysis indicates that the inertial movements of the viscera power ventilation of the lower (diaphragmatic) lobes of the lungs while

deformation of the chest wall powers ventilation of the upper (apical) lobes. Air does not flow in uniformly during inspiration; instead, gas is cycled between lobes in a four-stroke pattern. The asymmetric morphology of the lungs (with the right being larger in most mammals) is postulated to be a consequence not of the position of the heart but rather of the dextrally placed liver.

Competitive edge

The TATA binding protein (TBP) is necessary for transcription by all three RNA polymerases. Cormack and Struhl (p. 244) isolated temperature-sensitive (*ts*) mutations defective for transcription by RNA polymerase III in yeast by regional codon randomization. These mutations were mapped to a surface of TBP that may interact with a component of TFIIB (Tds4) because overexpression of Tds4 suppresses the *ts* phenotype. The mutations result in increased transcription by RNA polymerase II, suggesting that polymerases may compete for limiting factors.

Receptor release

Interferons (IFNs) help fight viral infections by inducing several antiviral proteins. Fischer *et al.* (p. 250) show that treatment of cells in culture treated with IFNs produces an extracellular soluble protein that they identify as the ligand-binding domain of the low-density lipoprotein receptor (sLDLR). Treatment of cells with sLDLR inhibited assembly or budding of vesicular stomatitis virus in infected cells. This effect accounted for most of the antiviral activity induced by IFNs.

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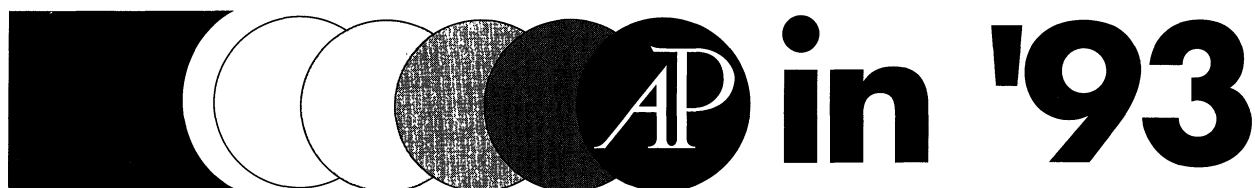
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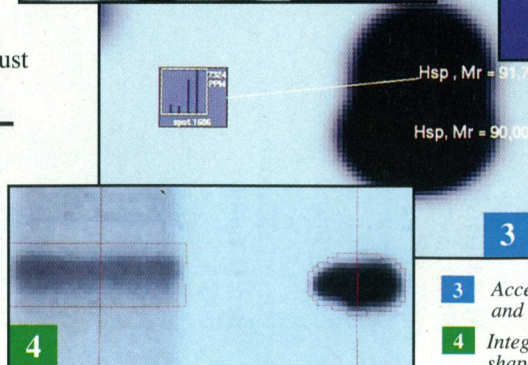
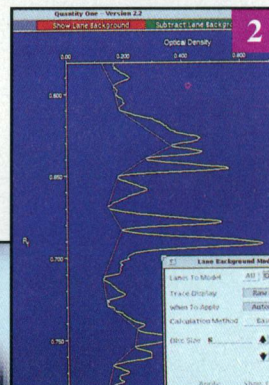
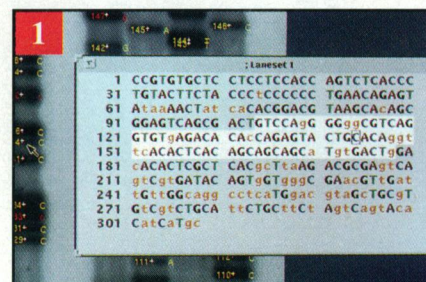
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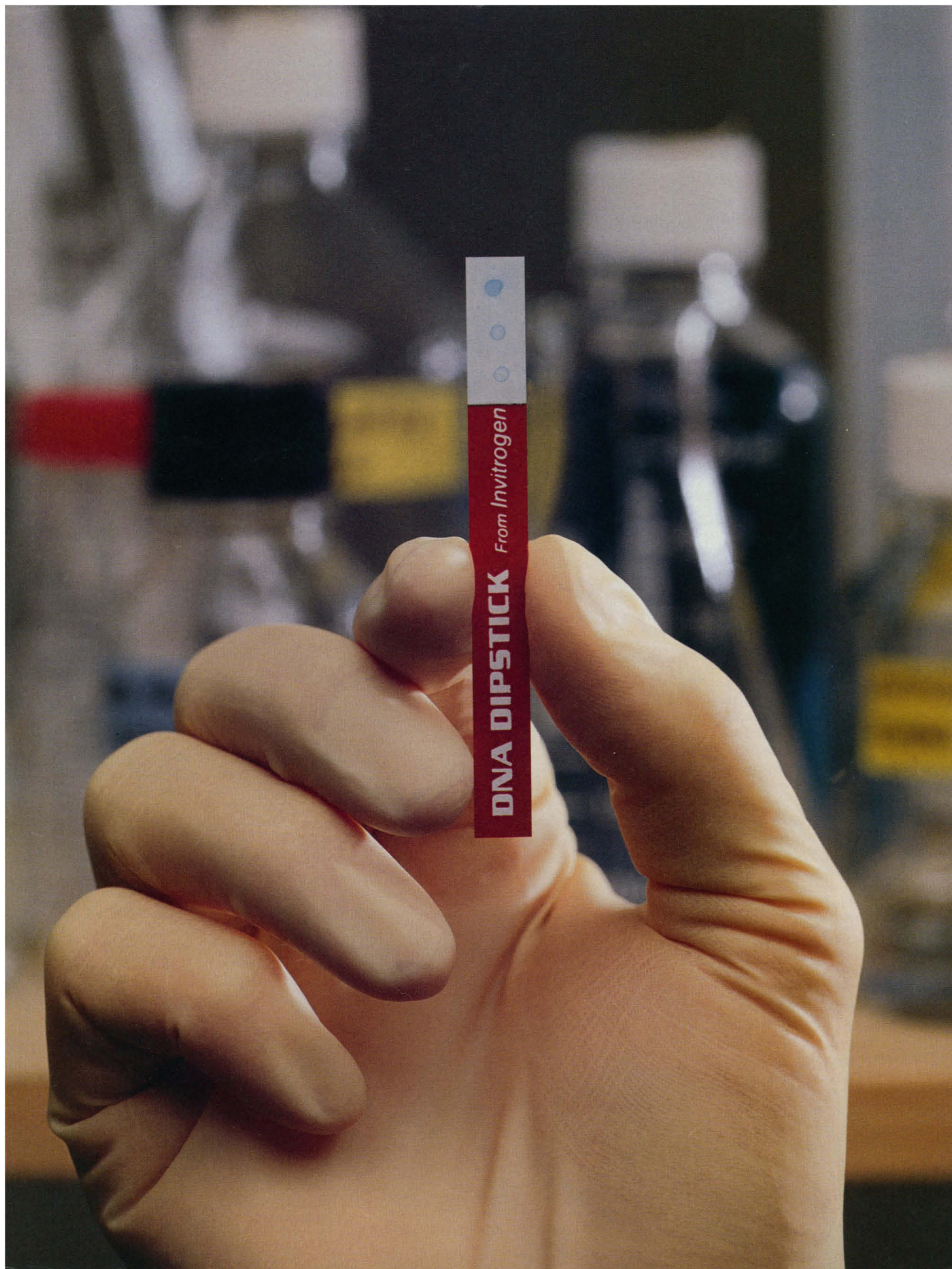
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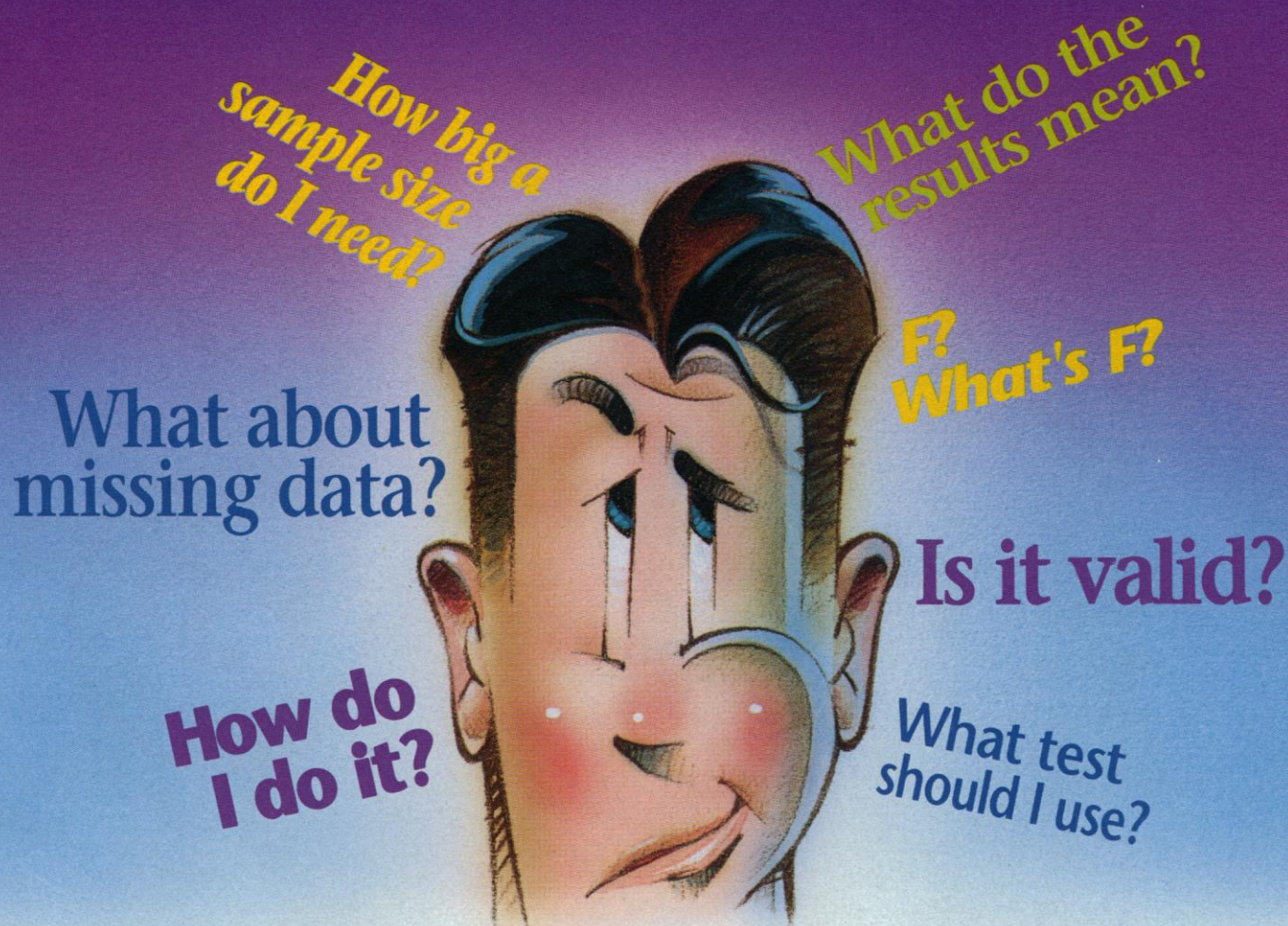
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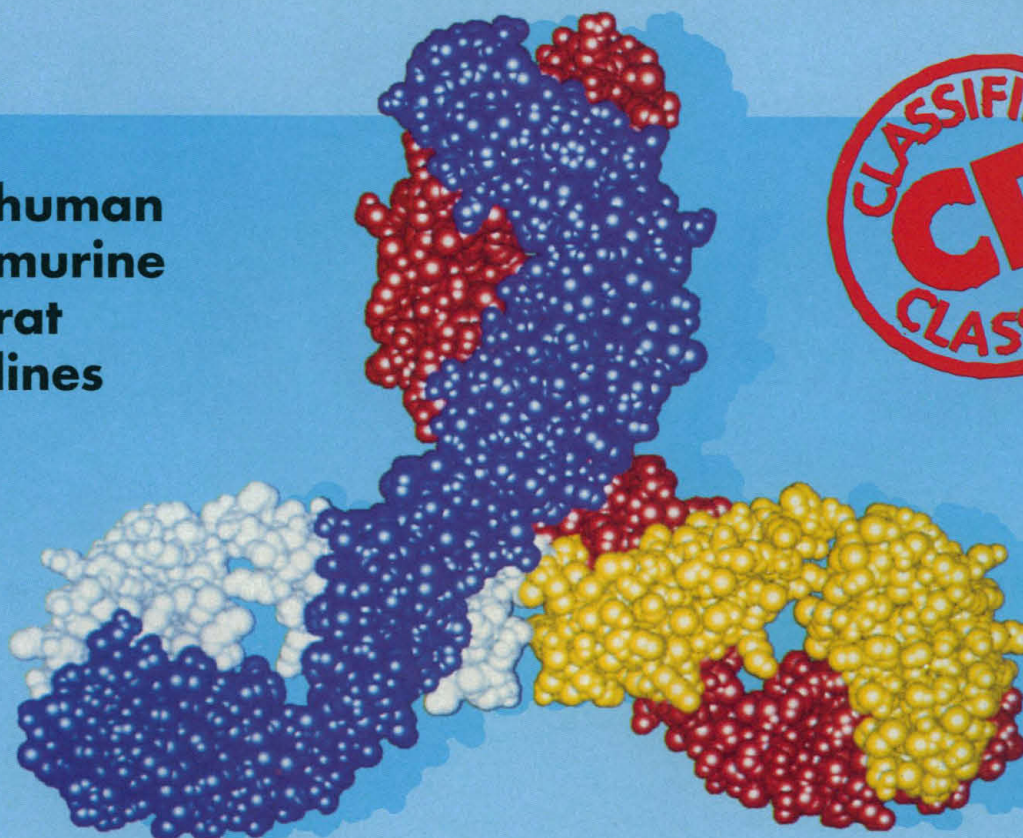
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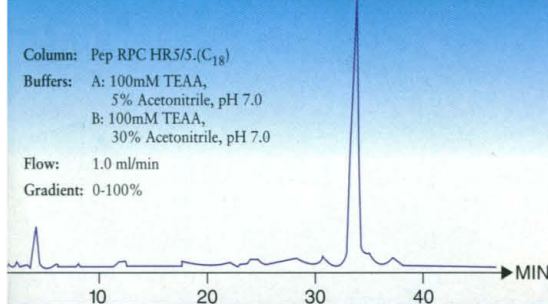
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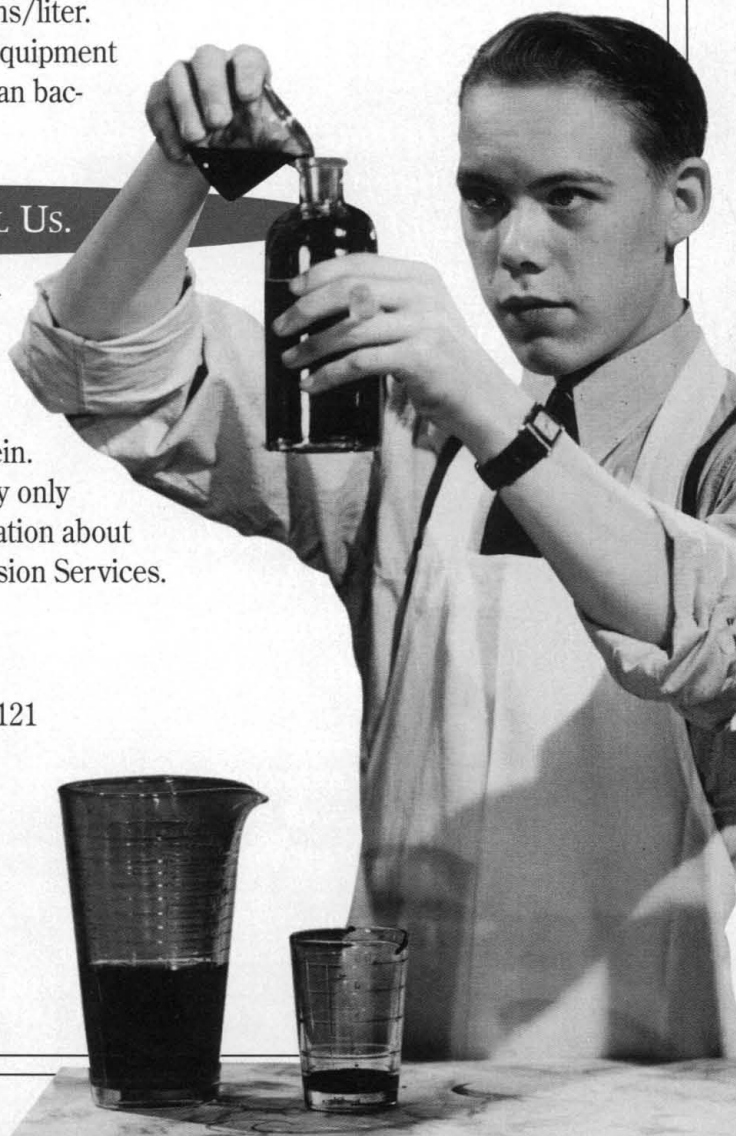


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