

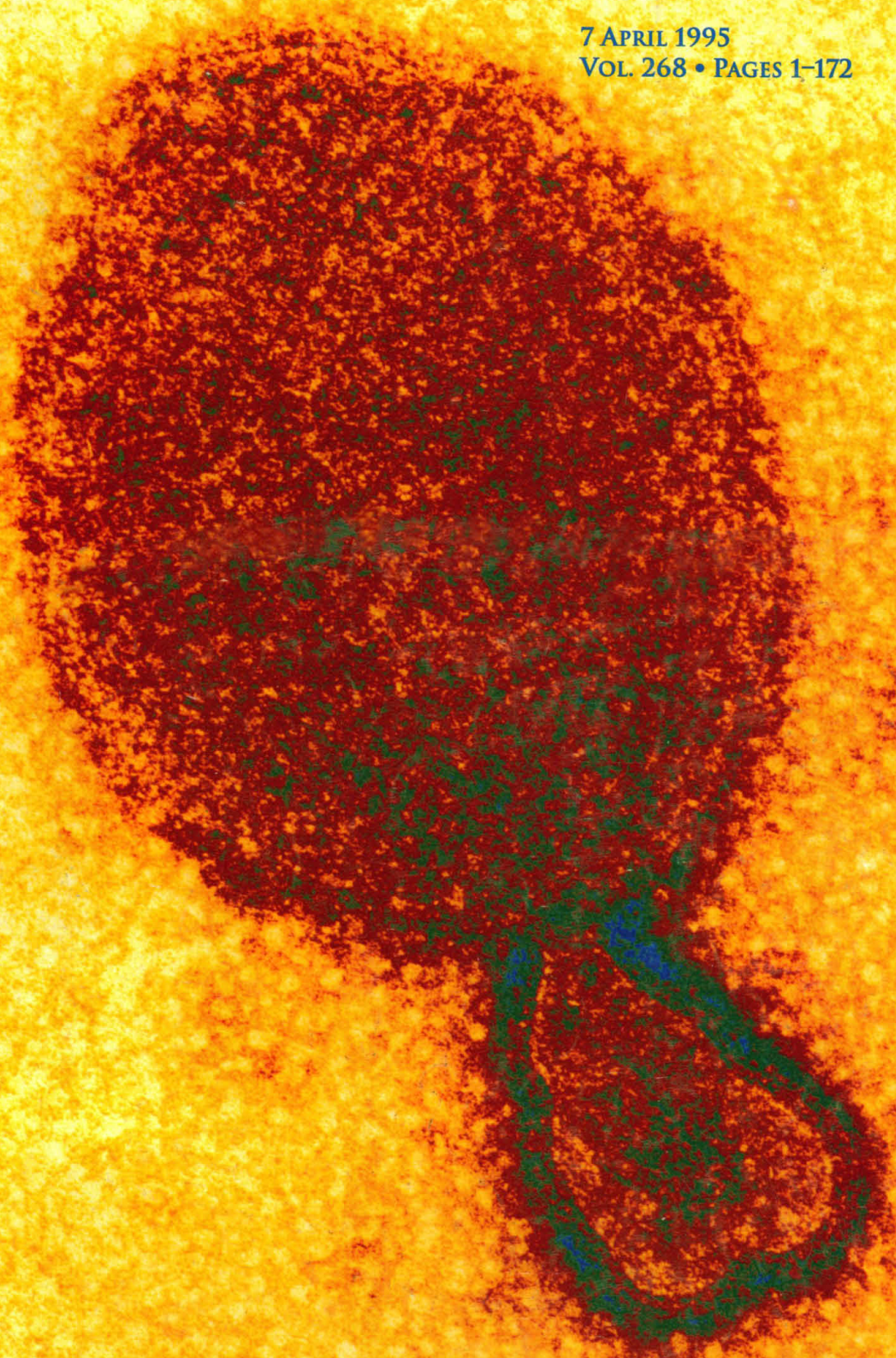


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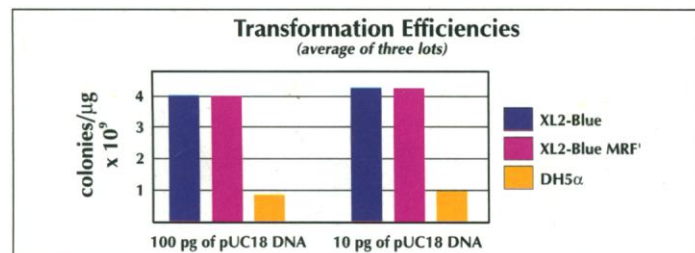
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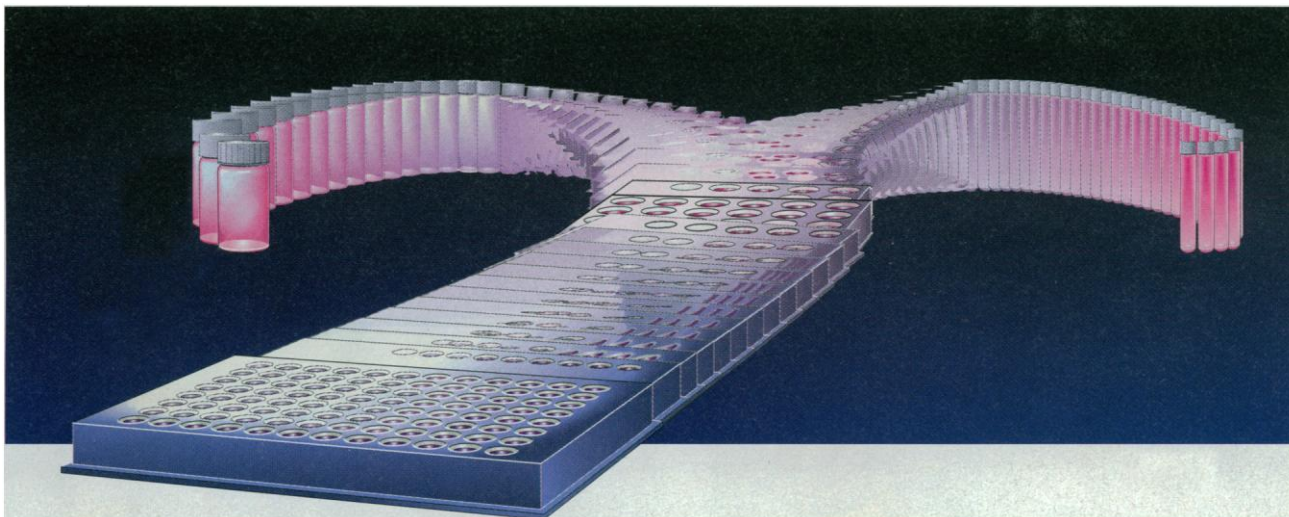


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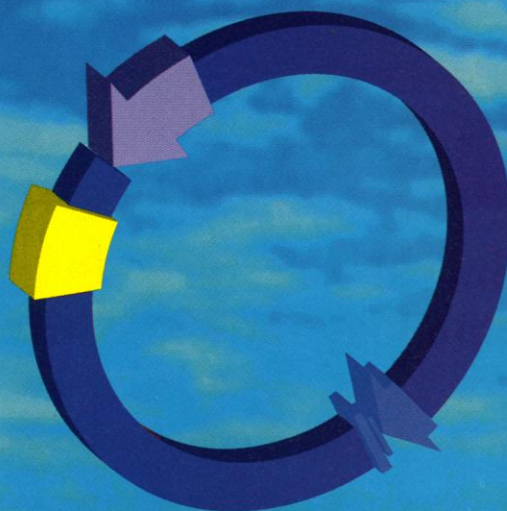
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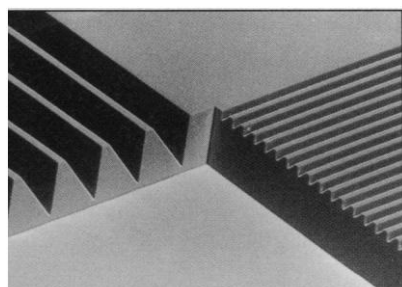
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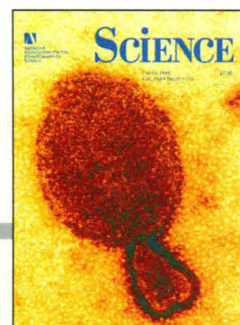
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COVER

Colorized image of a virus (vertical length, 696 nanometers) recently isolated in Australia from horses and one human who all died of acute respiratory disease. It is a previously unknown member of the genus

Morbillivirus, being a distant relation of other members such as the measles, distemper, and rinderpest viruses. See page 94 and the News story on page 32. [Photo: CSIRO Australian Animal Health Laboratory]



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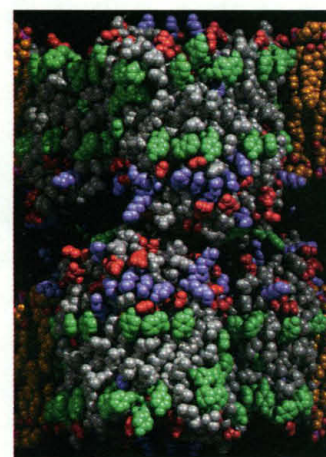
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Tracing the surfaces of a pore

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Long-playing record

The diversification and extinction of life is revealed, although incompletely, in the fossil record. Benton (p. 52) reviews recent finds that have filled in several gaps and expanded the database. A quantitative analysis of the record, focusing on the pattern of diversification and seven major extinctions, indicates that the timing of major extinctions is not periodic.

■

Not quite dry

Although olivine in Earth's mantle is nominally anhydrous, even a small degree of hydration in the upper mantle can strongly affect its α to β phase transition, which underlies the 410-km seismic discontinuity. Wood (p. 74) argues that the width of the transition interval must increase markedly for water contents from zero to a few hundred parts per million, and uses seismic data indicating the sharpness of the mantle discontinuity to conclude that upper mantle olivine can contain no more than 200 ppm of water.

■

Spin control

Ferritin consists of an iron oxide core surrounded by a protein shell and is of interest as an iron storage medium in biology and as a nanomagnet in condensed matter physics. Gider *et al.* (p. 77) synthesized ferritin with control over magnetic state and iron particle size, and have observed several classical and quantum mechanical spin phenomena, including glass-like spin relaxation and macroscopic quantum tunneling. Such particles could be used to enhance magnetic resonance imaging or to drive the magnetic orientation of molecular assemblies.

From one year to another

The precession of Earth's orbit about the sun, which has a 26,000-year period, is known to affect Earth's climate on that time scale but has been generally ignored in studies of short-term global temperature records that aim to discern the effect of anthropogenic greenhouse gases. In a statistical analysis of the temperature records, Thomson (p. 59; see also news by Kerr, p. 28) shows that precession cannot be neglected. For many records, temperature varies with the year defined by Earth's passage from perihelion to perihelion rather than the slightly shorter (by 1 part in 26,000) tropical or equinoctial year, which defines the seasons. Furthermore, the phase of many Northern Hemisphere records seems to have switched abruptly, in about 1940, from control by perihelion timing to coherence with changing atmospheric CO₂ levels. The analysis also suggests that variations in solar output have no significant influence on long-term temperature trends.

Flight maintenance

Rapid wing-beating by insects can be achieved either by muscular efficiency, so that wing direction can be changed with little effort, or by the use of an elastic energy reservoir that can rapidly store and return applied effort. Dickinson and Lighton (p. 87; see also Perspective by Alexander, p. 50) were able to study the energetics of trapped *Drosophila* by simultaneously measuring CO₂ respiration and torque generated by the flies, and by inferring from wing motions the insects' energy expenditures. The wing musculature is not extraordinarily efficient, but a modest elastic storage capacity suffices to keep the energetic cost of flying at a minimum.

■

Duality described

Integral membrane proteins possess an amphipathic surface, hydrophobic where the amino acids are embedded in the phospholipid bilayer and hydrophilic where they are exposed to the aqueous environment. This dual nature has frustrated structure determinations; no membrane proteins have been captured in

their native state, surrounded by attendant phospholipids. Schabert *et al.* (p. 92) used atomic force microscopy to trace, in situ, the profiles of the periplasmic and extracellular surfaces of the bacterial protein porin. Combination of these topographs with phospholipid models and the high resolution structure of the isolated protein then yielded an atomic scale model of the porin surface.

■

Kinder, gentler coral

Corals have long been regarded as strictly carnivorous, but Fabricius *et al.* (p. 90) have found an abundant soft coral from the Red Sea that subsists largely on phytoplankton. Because phytoplankton constitutes such a great biomass—perhaps 10 times the biomass of zooplankton in tropical waters—this discovery considerably increases the food resources available to reefs.

■

Recognizing the enemy

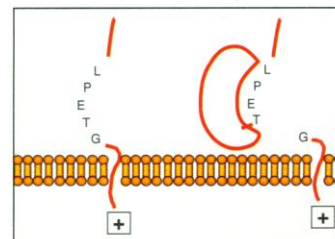
The molecular means by which helper T cells respond to specific antigens has eluded easy investigation. On injecting a

well-characterized antigen into mouse lymph nodes, McHeyzer-Williams and Davis (p. 106) found a 27-fold increase in the population of T cells responsive to the antigen. In T cell receptors (TCRs) expressed by this population, the length of a β chain segment known as complementarity-determining region 3 (CDR3) was strikingly consistent, suggesting that CDR3 length may be an important element in TCR recognition. The α and β TCR chains from individual lymphocytes showed a restricted sequence repertoire. The response to a second injection of antigen was still more homogeneous, indicating that, as with B cells, affinity maturation of the T cell response occurs in vivo.

■

Detached understanding

Bacterial pathogenicity derives in part from surface proteins anchored to the bacterial cell wall. Schneewind *et al.* (p. 103) designed a protease-resistant hybrid molecule that attaches to *Staphylococcus aureus* but which is released by enzymatic diges-



tion of the thick peptidoglycan layer on the cell wall. Different enzymes released the hybrid molecules with different cell wall fragments clinging to their anchoring ends. Mass spectrometry of the pieces led to identification of a new mechanism of protein attachment, which may ultimately offer a target for antibacterial therapy.

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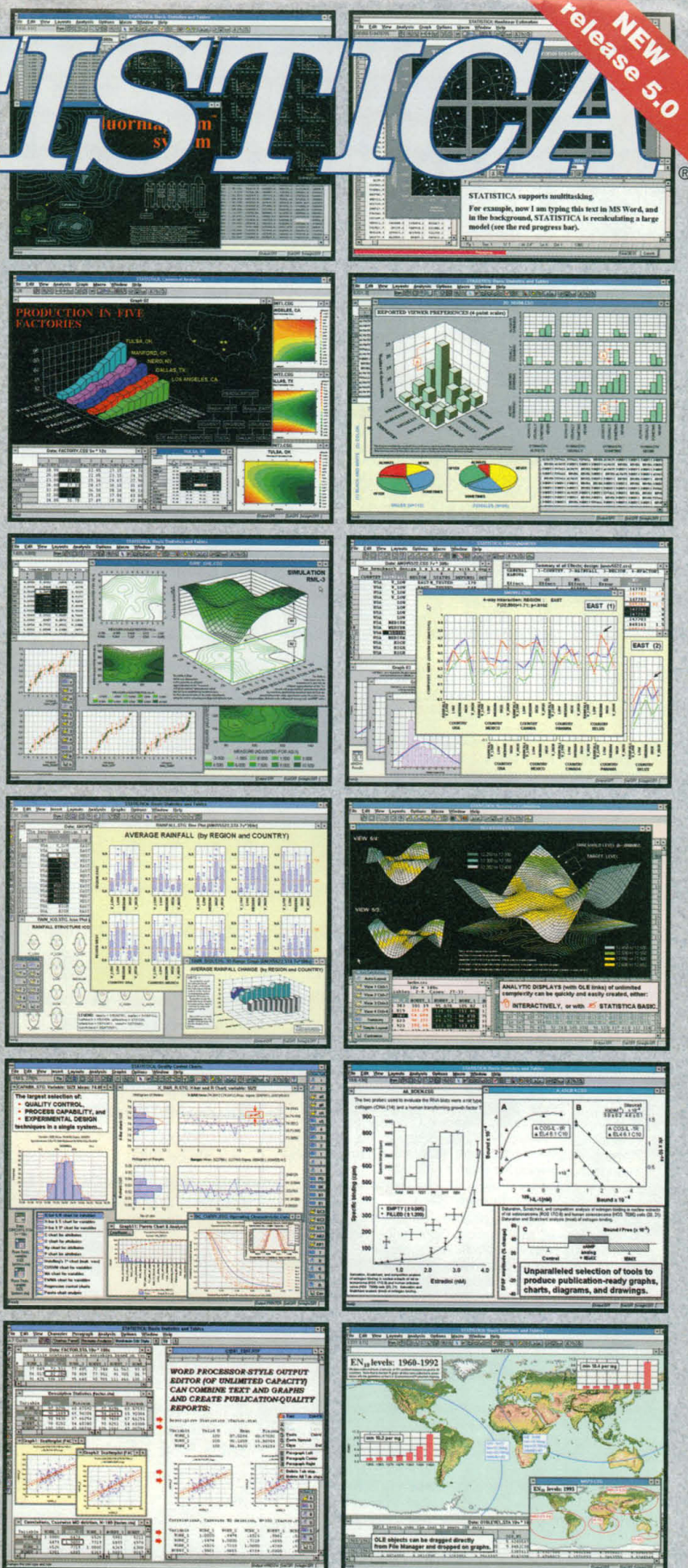


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ing, and upgrading the national backbone and extending technical support to local and regional "point-of-presence" centers that are mushrooming throughout Brazil, thanks to the "Rede Nacional de Pesquisa."

Da Costa's Policy Forum about the "Future of science in Latin America" (p. 827) mentions a ban on the hiring of foreign researchers at Brazilian federal laboratories. I am pleased to say that, as of 3 February, the National Immigration Council has authorized extending permanent visas to foreign researchers or skilled technical professionals who wish to work in Brazilian research institutions and universities. This step will greatly assist in broadening the scope and the depth of the international scientific contacts that Brazilian scientists have so successfully developed over the years.

Paulo-Tarso Flecha de Lima
Ambassador to the United States,
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The perceptive article by Eliot Marshall about the Brazilian synchrotron light source (p. 813) is a fair and accurate description of the Laboratório Nacional de Luz Síncrotron (LNLS). However, the title of the article, "Physicists hand-build a synchrotron" may

give the reader the wrong impression. Perhaps, "manufacture" would have been a more appropriate term than "hand-build." In an experience not much different from those of the early days at CERN or, even, at Fermilab, LNLS is building many components in-house because we could not find local industries capable of delivering what was needed within the specifications and for reasonable costs. In doing so, however, LNLS uses fairly sophisticated machine tools and has developed innovative procedures, such as laser cutting for the laminations of the storage ring magnets.

The strategy of LNLS, from the very beginning, has been to build as much as possible of the storage ring in Brazil, although buying abroad would be, in many cases, cheaper. This is not dictated by funding considerations, but by the very aim of the project: to develop and incorporate as much technological know-how as pragmatically possible. The same basic strategy dictated developing the project in-house with minimal help from foreign experts and consultants. The type of international cooperation LNLS seeks is exemplified by the Center for Advanced Macrostructures and Devices-LNLS agreement—a partnership where both sides contribute and benefit.

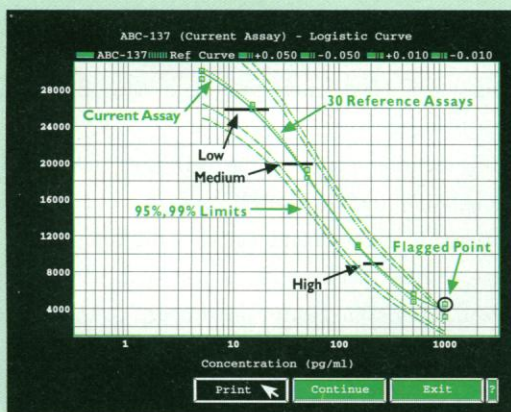
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DES History

Readers of the book review by William P. Browne of *Cancer from Beef* by Alan I. Marcus (Johns Hopkins Univ. Press, 1994) (20 Jan., p. 394) may incorrectly conclude that Purdue University was involved with the Pfizer Corporation in diethylstilbestrol (DES) studies. A series of studies of the endocrine regulation of growth and body composition of domestic animals was begun at Purdue in 1940. By the late 1940s, we had shown that DES appeared to have an anabolic effect in sheep and cattle. This was unexpected, as studies in rodents had shown no evidence of anabolicity. Our findings were soon confirmed by colleagues at the universities of Wisconsin and California, Davis. It was well known that DES was a powerful, nonsteroidal estrogen and effective orally and parenterally in a number of vertebrates. The Purdue studies were designed for practical applications; compressed pellets containing small quantities of DES were implant-

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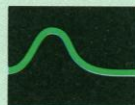
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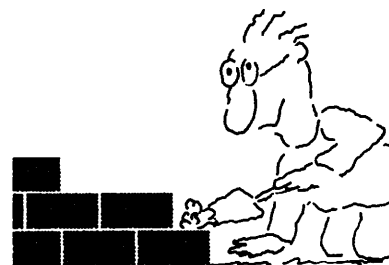
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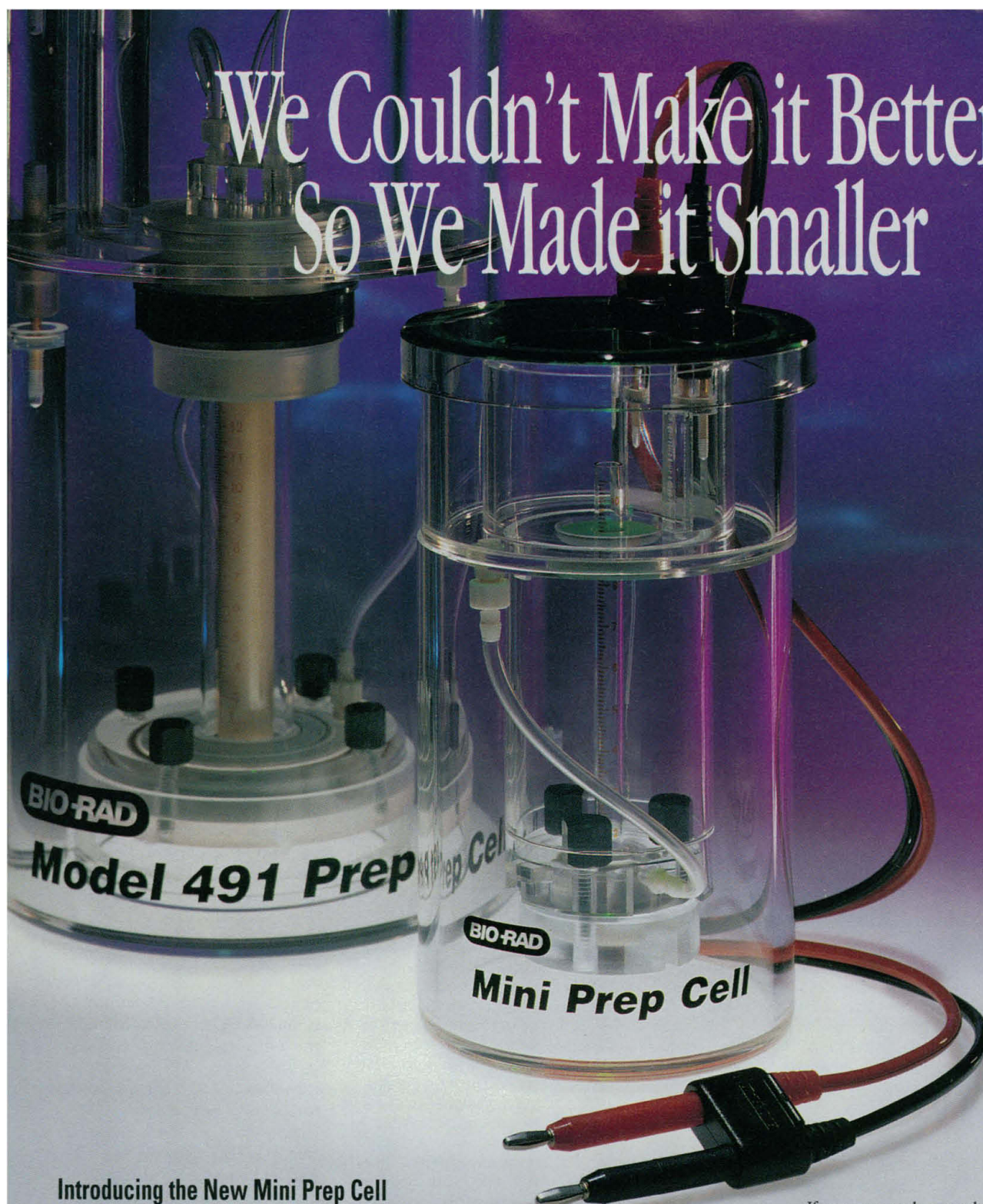
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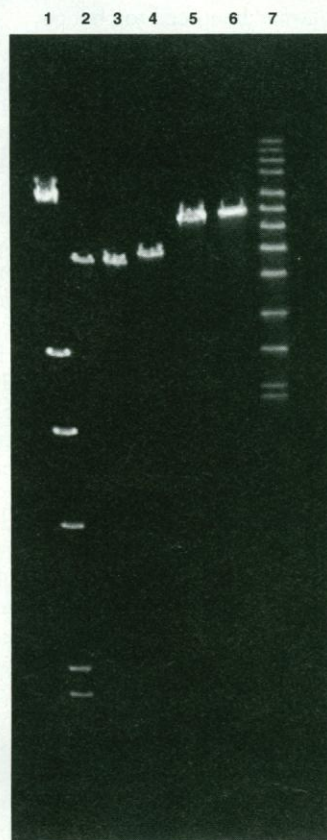
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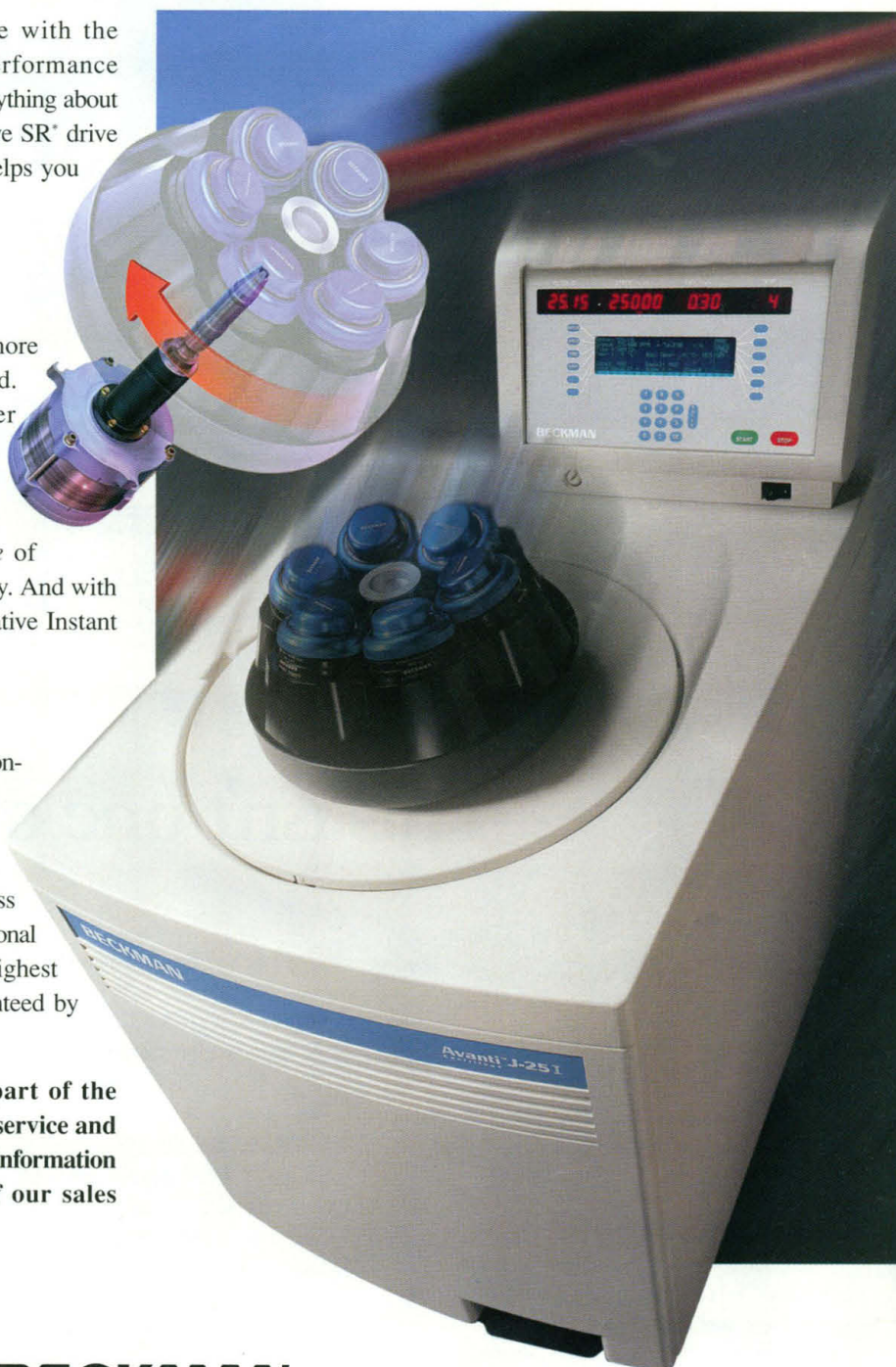
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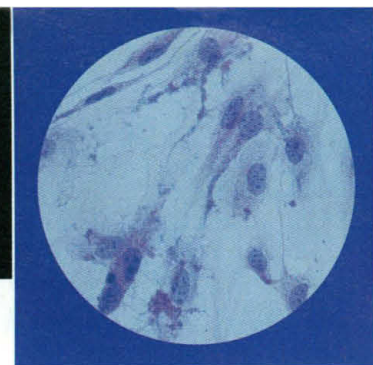
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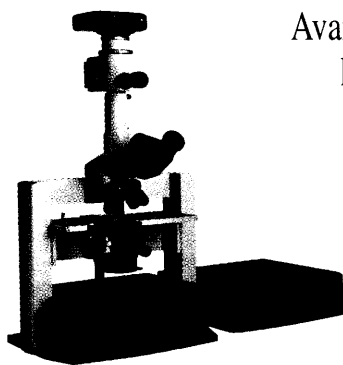
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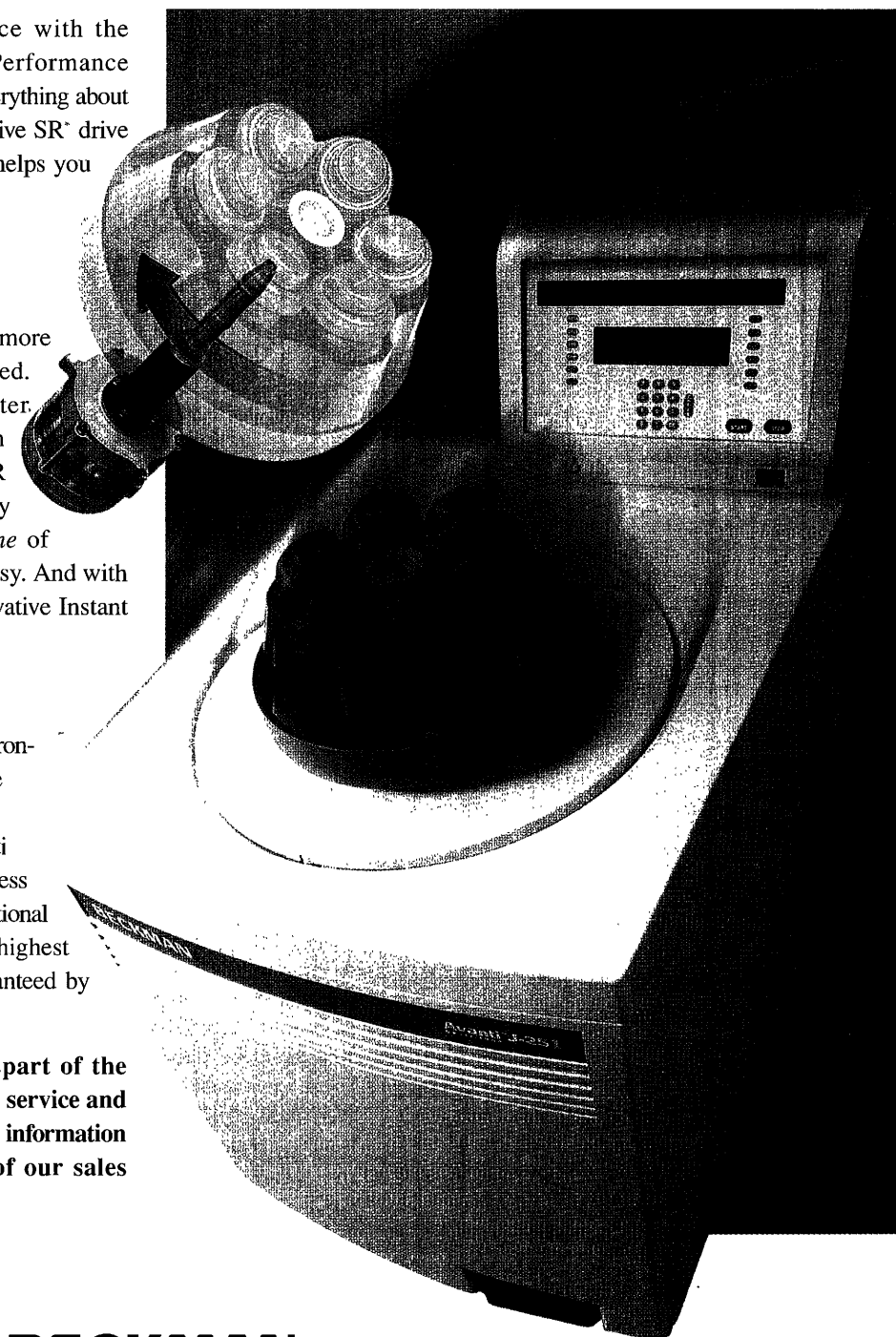
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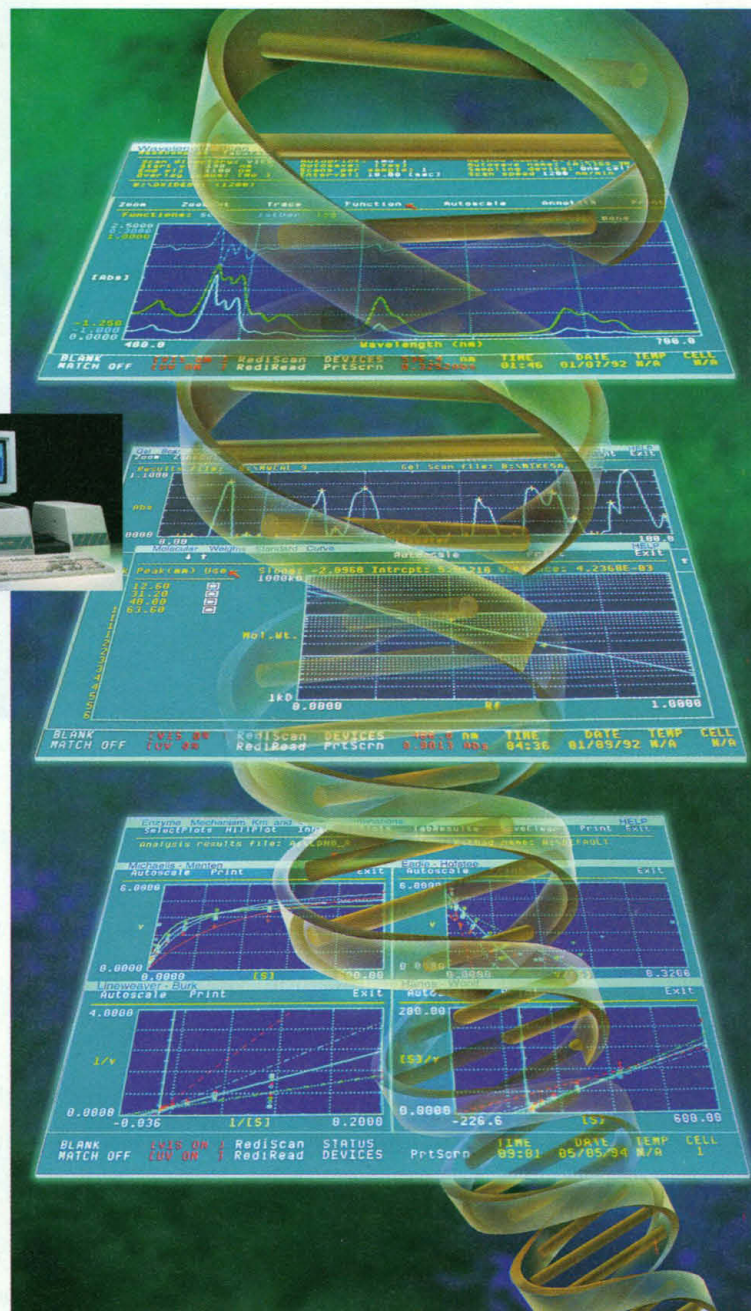
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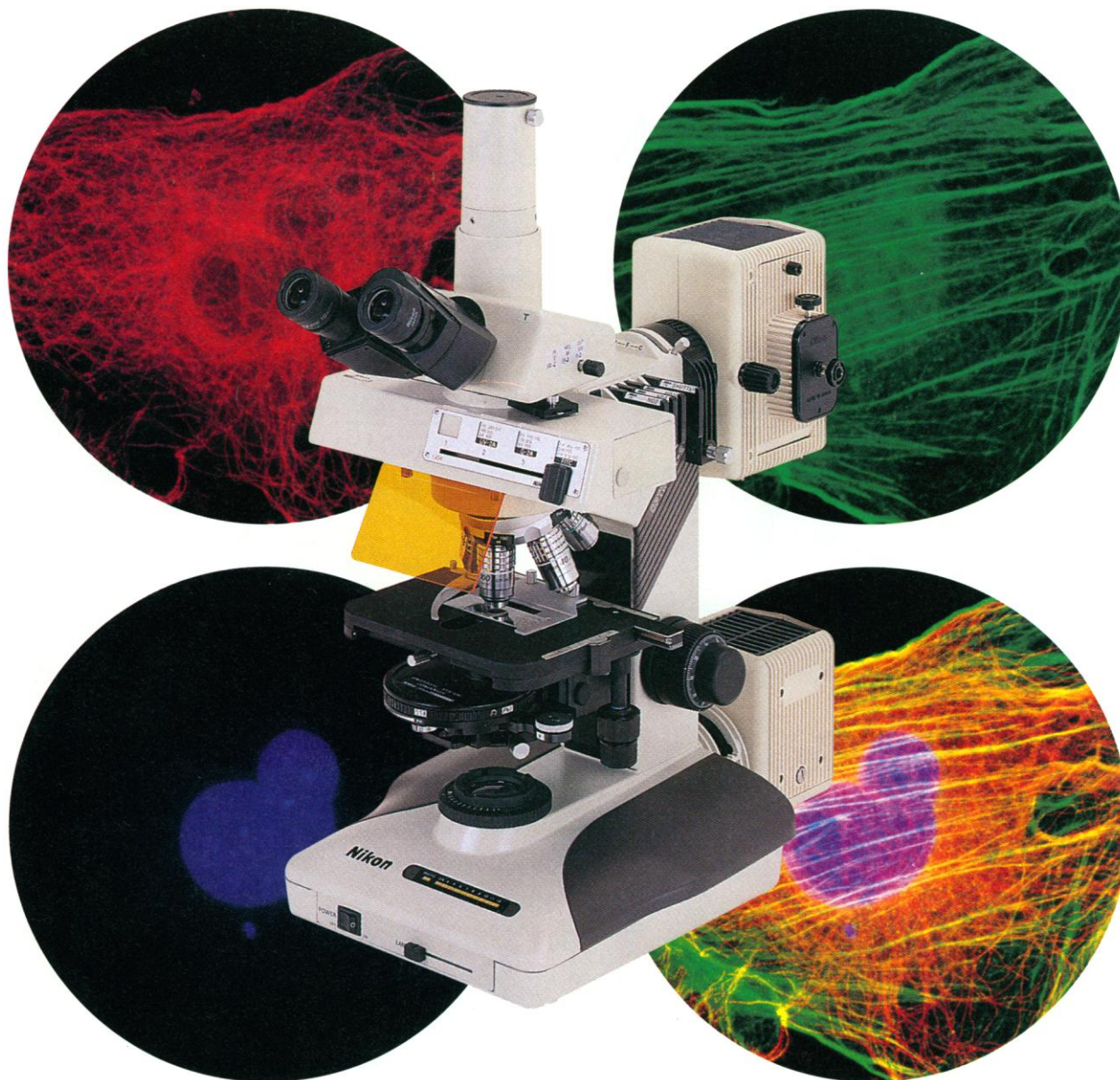
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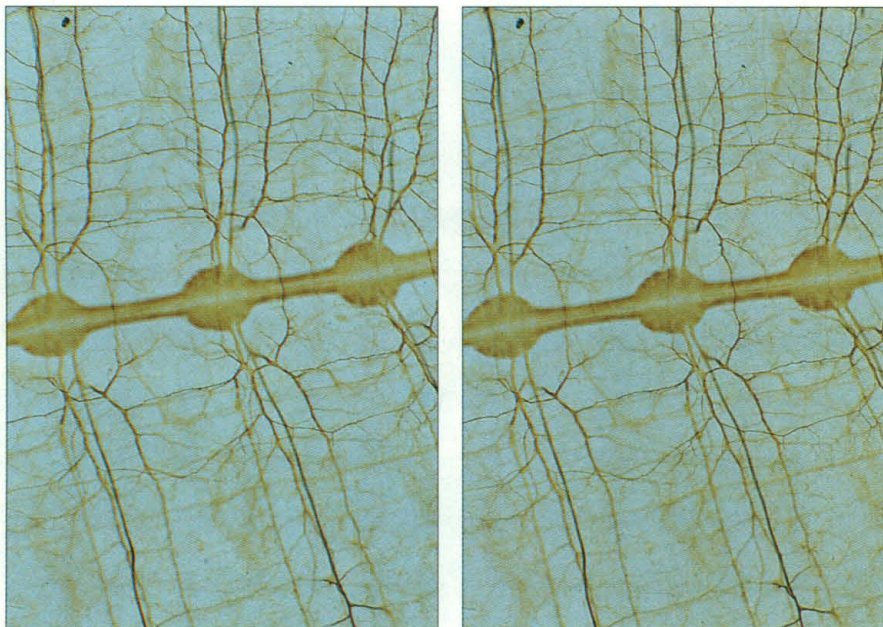


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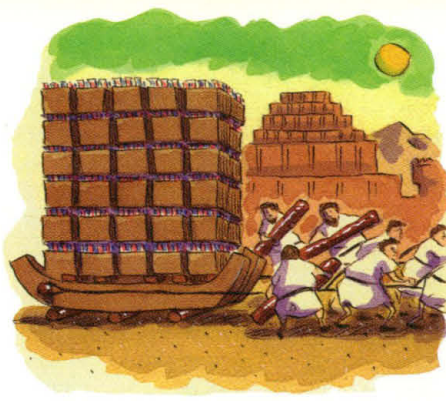
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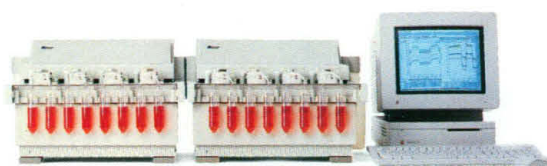
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1. Science 257, 1906-1912, (1992) 2. J. NIH Research 5, 69, (1993)

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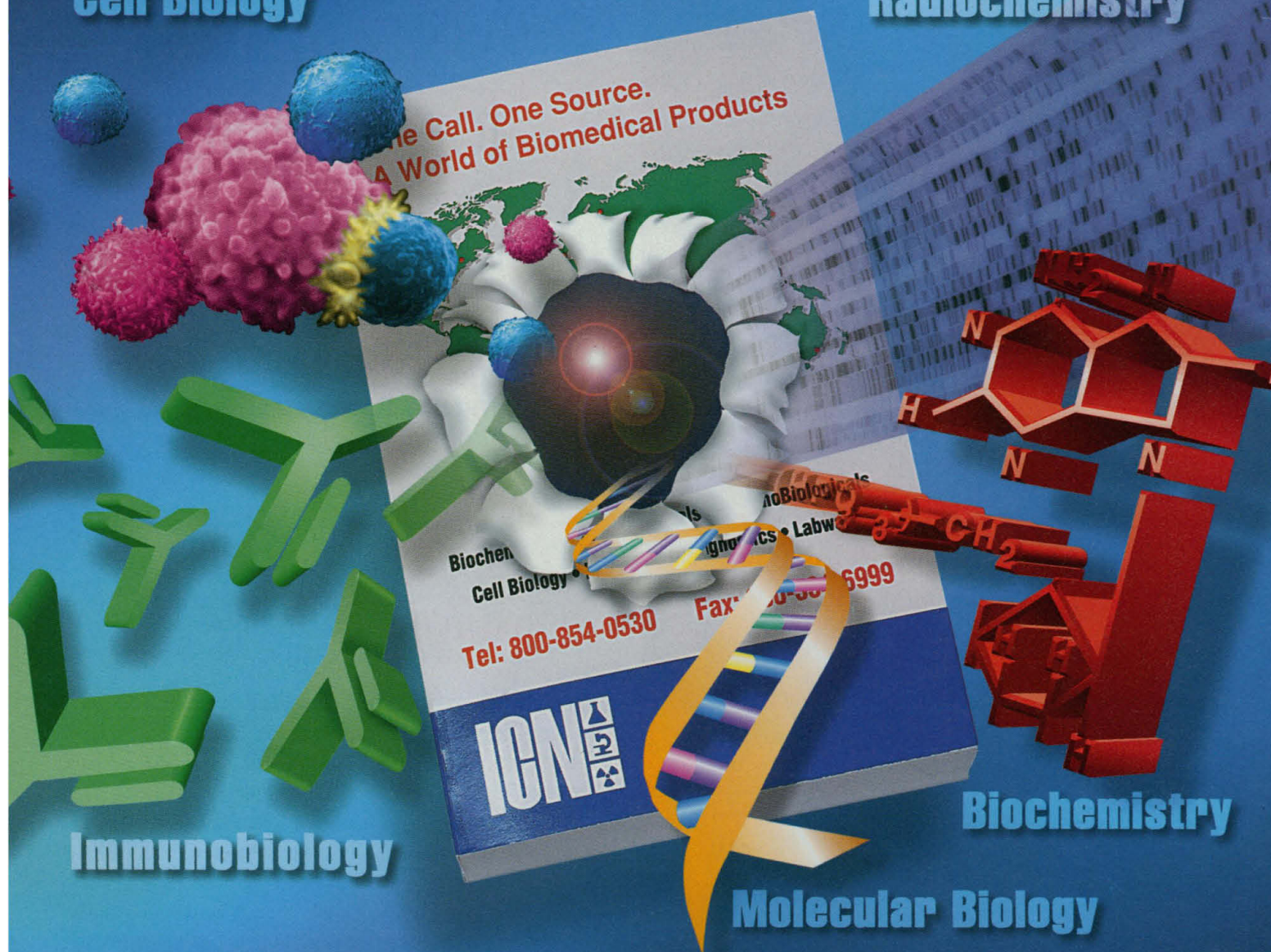
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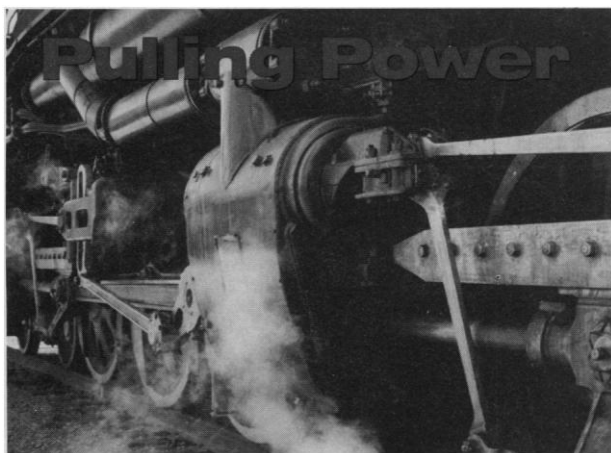
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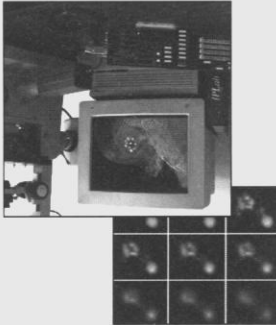


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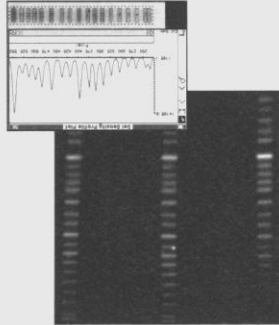
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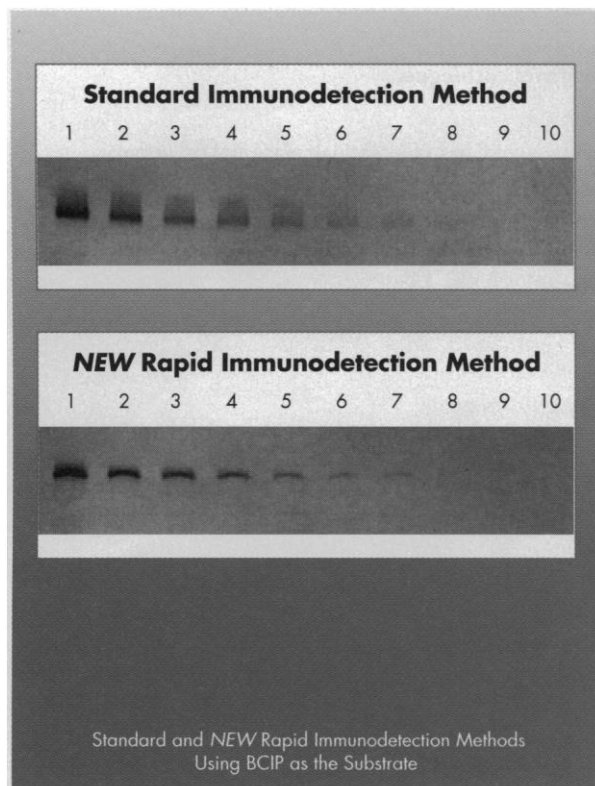
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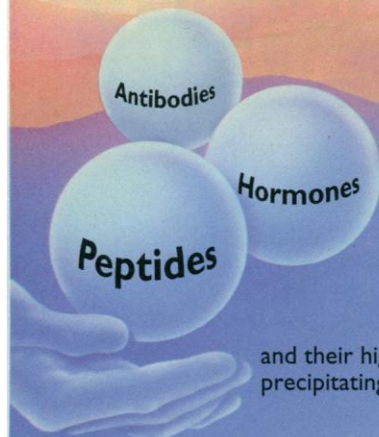


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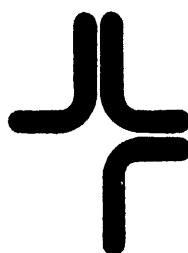
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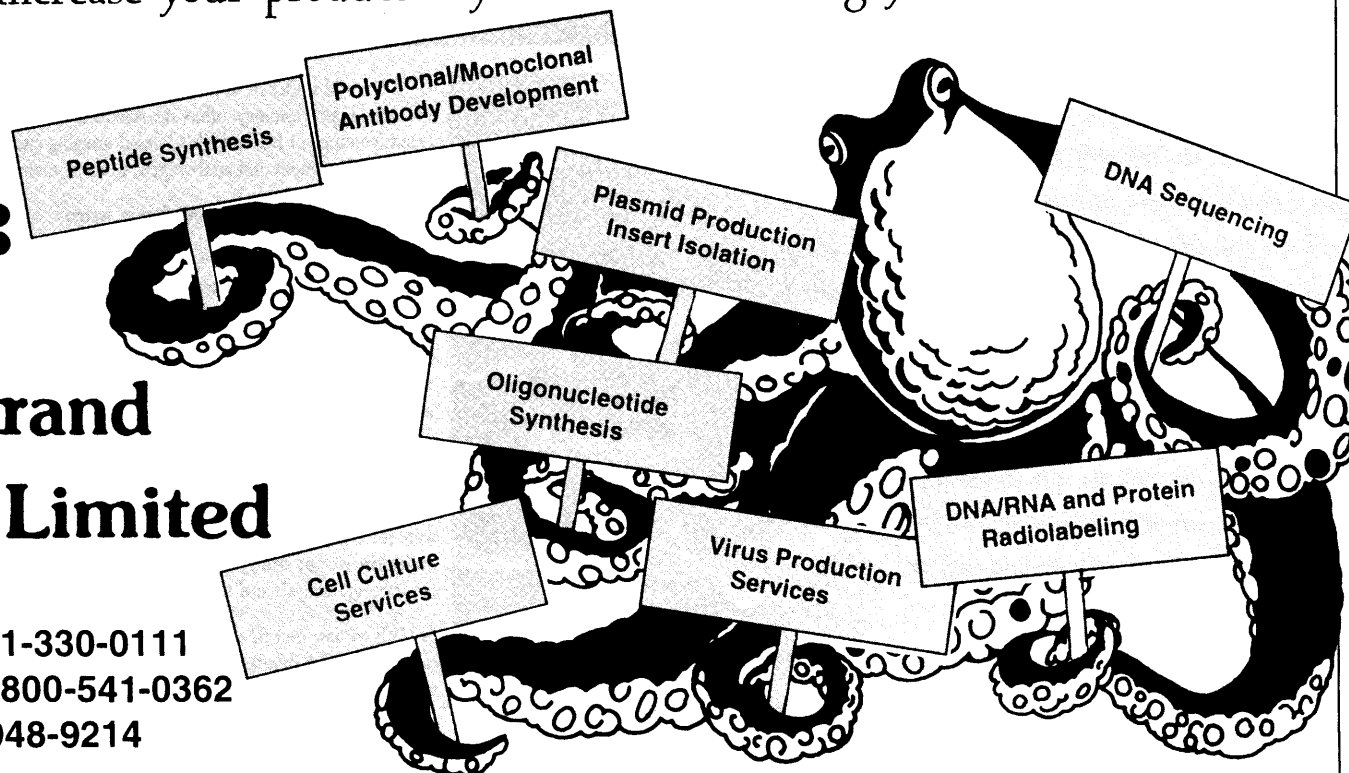
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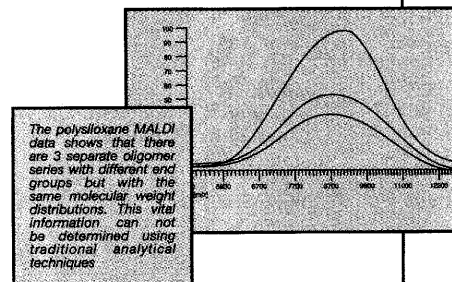
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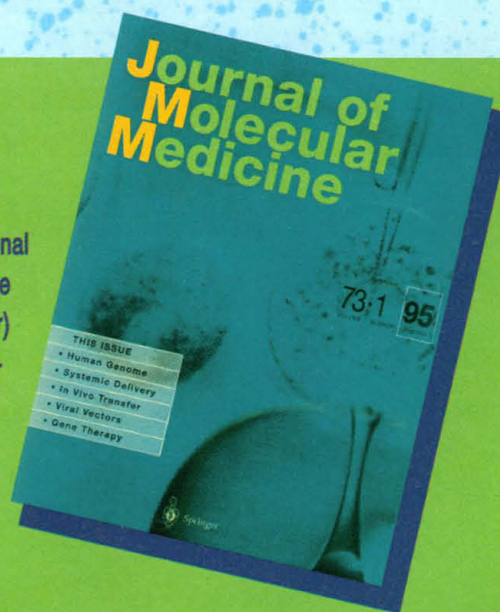


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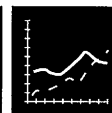


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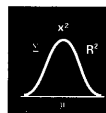
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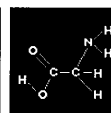
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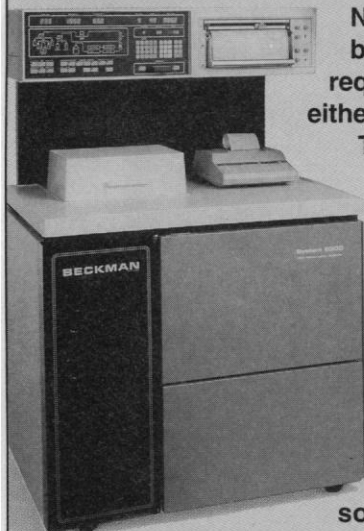
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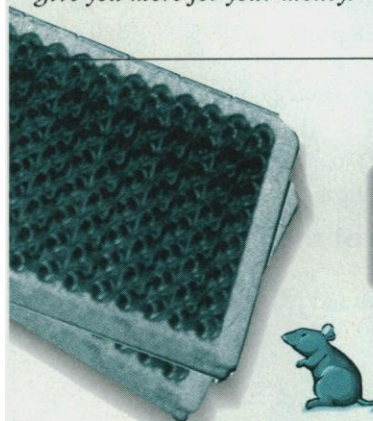
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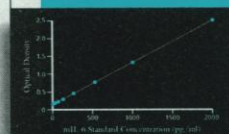
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