

Science

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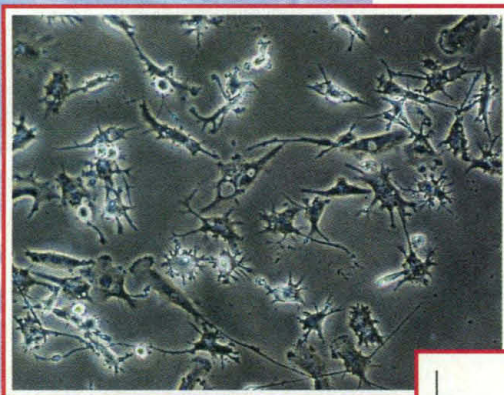
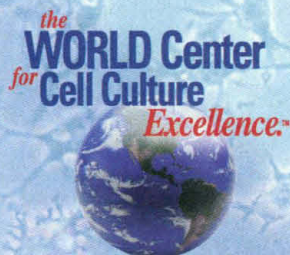
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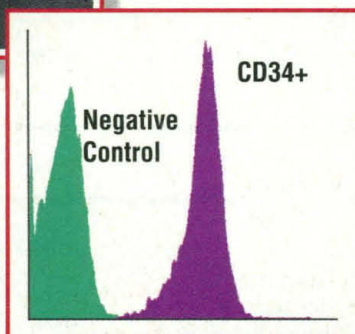
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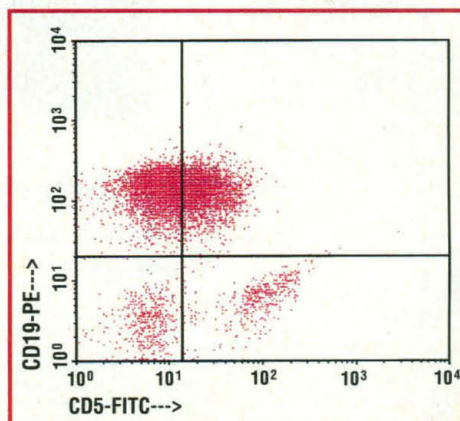
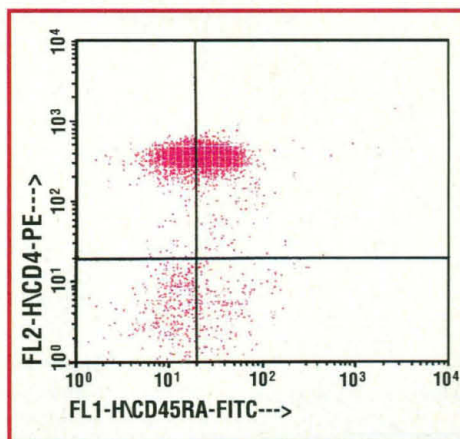


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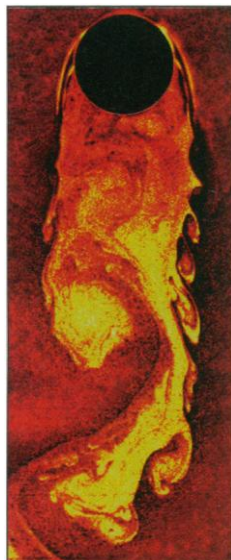
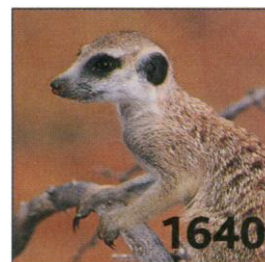


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COVER In some animal societies, one individual watches for predators while others forage. A study of meerkats (*Suricata suricatta*) in the southern Kalahari suggests that guarding is in an individual's own interests if no other animal is on guard, once its stomach is full. The alternation of guards favors no regular rota and apparently occurs because the relative benefits of feeding versus guarding increase the longer an individual is on guard and as it continues to feed. [Image: T. H. Clutton-Brock]



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2D wind tunnel

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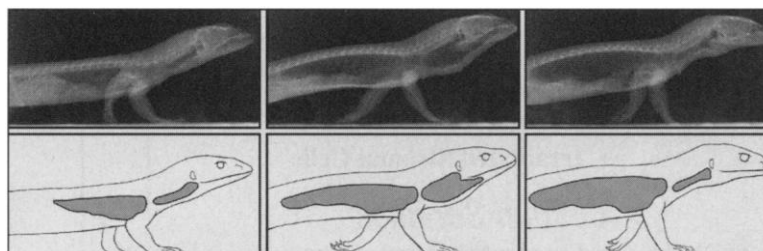
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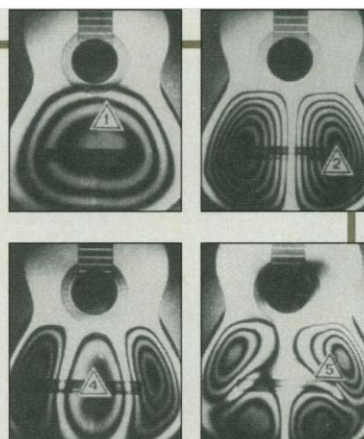
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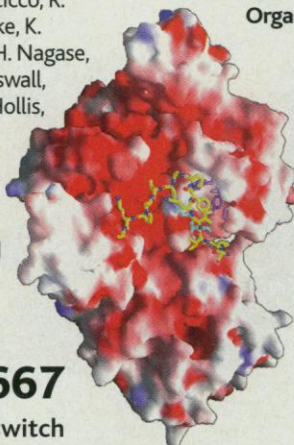
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Uncapping the switch



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Cloning Blunt-End PCR Products?

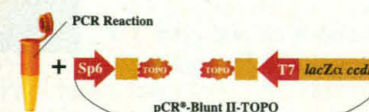
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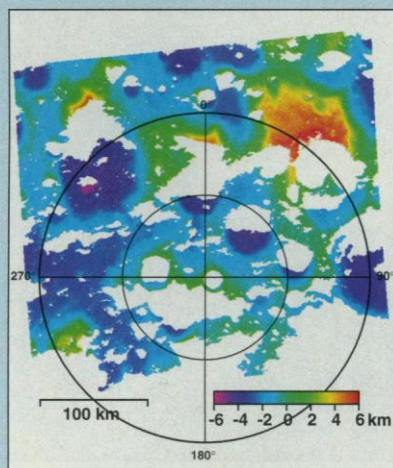
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SHADOWS AT THE LUNAR POLES

Data from the Clementine and Lunar Prospector spacecrafts have suggested that the lunar poles may harbor long-standing water ice deposits within craters that do not receive direct sunlight. Margot *et al.* (p. 1658) have obtained high-resolution topographic maps of both poles using ground-based radar interferometry with the Goldstone Solar System Radar. They



then traced sunlight rays hitting the cratered poles and determined which regions would never receive sunlight for a complete solar illumination cycle. The estimates of shadowed area at the south pole are two to three times at the north pole, and may indicate that the hydrogen abundances estimated from Lunar Prospector are not related entirely to water ice or that water ice is mixed with the regolith layer. Although the authors have focused on estimating the amount of water ice at the poles with their topographic maps, these maps also can be used to understand crater dynamics and the internal structure of the moon, as well as for pinpointing a target crater for a proposed spacecraft impact.

EARNING YOUR STRIPES

Thin films of organic charge-transfer complexes, which contain one-dimensional columns of segregated anions and cations, possess unusual electronic properties. Kumai *et al.* (p. 1645) have found that the application of high electric fields along the axis of the columns results in the material reversibly switching from a high-resistance insulating state to a low-resis-

tance state, which is associated with dielectric breakdown in the complex. The breakdown does not occur across the bulk of the material, but is localized and results in the formation of alternating metallic and insulating stripes oriented perpendicularly to the current flow.

EXCITED TO THE BREAKING POINT

Although chemists can excite molecules with photons to initiate reactions, the process often changes the bonding (electronic structure) of the molecule. Examples of initiating chemistry just by adding large amounts of vibrational energy to a molecule to snap a bond apart are rarer, especially for surface reactions, where it is thought that the molecule would lose energy rapidly to vibrations of the crystal (phonons). Nonetheless, Hou *et al.* (p. 1647; see the Perspective by Holloway) find that putting ground-state NO molecules into high (13th and 15th) vibrational states increases their probabilities of reacting with a copper surface almost 1000 times to values near unity.

STUCK ON LUBRICANTS

Amontons' laws state that the force needed to overcome friction (either from rest or while in motion) is directly proportional to the load and independent of the contact area. Although these observations are 300 years old, they have evaded a microscopic description—in simulations, perfectly flat surfaces usually glide past each another. He *et al.* (p. 1650) argue that the presence of third bodies between the opposing surfaces (such as adsorbed hydrocarbon molecules) accounts for static friction. They performed molecular dynamics simulations, which show that adsorbed hydrocarbons can create an attractive potential minimum between atomically flat surfaces for realistic loading pressures.

VOLCANIC SULFUR

The well-documented 1991 eruption of Mount Pinatubo released 17 megatons of sulfur dioxide into the atmosphere. The sulfur dioxide was oxidized into sulfate aerosols that reduced the amount of sunlight reaching Earth's surface and thus contributed to subsequent global cooling. The calculated amount of sulfur dioxide released from a given volume of erupted magma underestimates the observed amounts by one to two orders of magnitude. Keppler (p. 1652) conducted labora-

tory experiments to determine how sulfur distributes between a hydrous fluid and a melt (magma). The large partition coefficient indicates that a small amount of fluid may extract most of the sulfur from the magma reservoir; the ejection of this fluid upon eruption would account then for the apparent excess of sulfur dioxide in the volcanic gases.

UNEVEN EFFECTS OF DEGLACIATION

The Greenland ice cores have provided valuable climate records at nearly annual resolution throughout the Holocene and into the Pleistocene. Comparisons with climate records at lower latitudes, which would help to elucidate processes responsible for climate change, have been hindered by the paucity of other well-dated and comparably resolved records. Now, von Grafenstein *et al.* (p. 1654) present an oxygen isotope record from cores in the Ammersee, a hard-water lake in southern Germany, with a temporal resolution of approximately 11 years. The timing of climate changes matches closely the climate record from the Greenland ice cores when compared at decadal and centennial scales. One difference, however, is that the oxygen isotope trends do deviate on the scale of thousands of years, possibly reflecting a northward shift in the response of North Atlantic circulation to deglaciation.

EATING THE EXTRACELLULAR MATRIX

Matrix metalloproteinases (MMPs) are enzymes that degrade extracellular matrix during normal connective tissue turnover and cell migration. Because MMPs are also thought to play major roles in both tumor metastasis and degenerative diseases, they are important targets for drug development (see the news stories by Hagmann). Some MMPs are secreted as inactive proforms and become partially activated upon proteolysis by other enzymes. Molecular details of this activation are revealed through the crystal structure of human proMMP-2 reported by Morgunova *et al.* (p. 1667). Proteolysis of exposed loops in the propeptide domain uncovers the catalytic domain of MMP-2. The degradation of some biomolecules, such as aggrecan, point to MMPs that have yet to be characterized. Aggrecan is a large chondroitin sulfate proteoglycan found in cartilage that deteriorates during osteoarthritis,

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THIS WEEK IN SCIENCE

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rheumatoid arthritis, and other arthritic conditions. It functions as a shock absorber in the joint, and its degradation by proteolytic cleavage is an irreversible process. Tortorella *et al.* (p. 1664) report the isolation from cow of an enzyme responsible for this process, called aggrecanase-1. They also report the cloning and expression of the human enzyme and provide a rank order of aggrecanase inhibitor potency with a view toward the design of therapeutic compounds.

SELFISH SURICATE SENTINELS

The posting of sentinels by groups in danger is a feature of human societies. In some animal societies, too, individuals take turns to watch for predators from raised positions, an apparently selfless behavior that has long been explained by kin selection or by reciprocal altruism. Recently, however, this selflessness was called into question by a model that suggested that sentinel behavior could arise from selfish antipredator motives. Clutton-Brock *et al.* (p. 1640; see the cover and the Perspective by Blumstein) have experimentally tested and confirmed six predictions of this explanation of guarding in suricates (meerkats). In this highly social and cooperative mammal, sentinel behavior is explained by an individual's nutritional state: guarding is the optimal activity once it has a full stomach.

NATURE AND NURTURE AND BEHAVIOR

Studies of the genetic contributions to behavior often have relied on the use of inbred strains of mice that show certain behaviors consistently. However, Crabbe

et al. (p. 1670; see the news story by Enserink) demonstrate that subtle environmental differences may provide unsuspected and confounding variables. Inbred strains of mice were tested in three geographically separate laboratories for behavioral differences in exploratory and locomotor activity, spatial learning, anxiety, and responses to cocaine and alcohol. Despite stringent efforts to standardize environmental conditions, protocols, and apparatus, significant lab-based differences were observed. Differences were observed even in characterizing the phenotype resulting from deletion of the gene encoding the serotonin 1B receptor. These data emphasize the need to identify genes whose effects are not as susceptible to environmental effects, to identify and control for environmental variables, and to repeat experiments in multiple laboratories.

LIVING QUARTERS

Quarter-power scaling relations link body mass M with any number of biological variables; for example, the diameters of the tree trunks and aortas scale as $M^{3/8}$, cellular metabolism as $M^{-1/4}$, and the blood circulation time and life-span as $M^{1/4}$. West *et al.* (p. 1677; see the news story by Mackenzie) present a generalized explanation for this phenomenon based on the proposal that organisms are sustained by hierarchical fractal-like structures that terminate in size-invariant functional units, and that the surface area for acquisition of resources is maximized while the energy dissipated in the distribution mechanism is minimized. The authors liken the fractal network to a fourth spatial dimension of life.

TECHNICAL COMMENT SUMMARIES

Tree Species Diversity in Logged Rainforests

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/284/5420/1587a

C. H. Cannon *et al.* (Reports, 28 Aug., p. 1366) studied the effects of commercial logging on tree species diversity in a tropical rainforest in Indonesian Borneo. They concluded that, in a forest selectively logged 8 years previously, there was "high tree species richness, despite severe structural damage."

D. Sheil *et al.* comment that comparisons in the report are "confounded by differences in stem counts per sample, because species-individual ratios decline with increasing stem numbers in any community." A "greater concern" is that "species are not equivalent, and species counts do not represent any inherent conservation value or provide a measure of ecological integrity."

In response, Cannon *et al.* "applied a transformation that linearizes a power function" to their data and "again found that the number of tree species...is greater" in the logged than in the unlogged forest. "Pioneer or invasive species" were not responsible for the pattern observed. They conclude that these selectively logged forests "represent conservation and research opportunities that may not be available in the near future."

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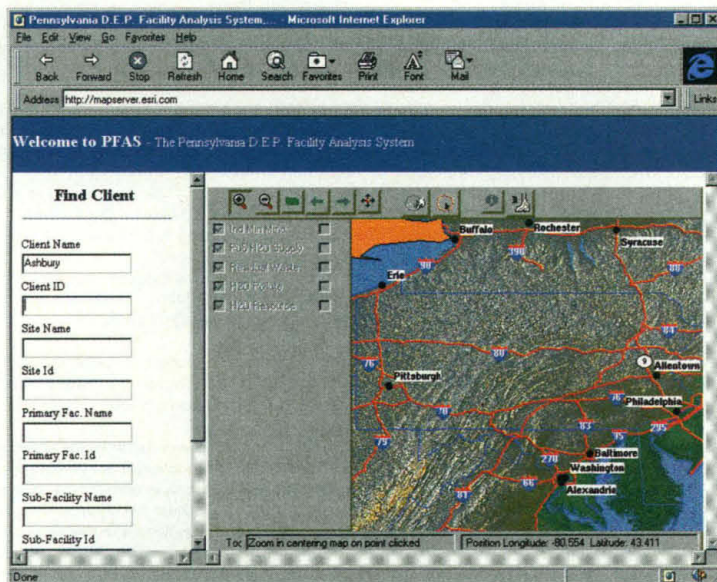
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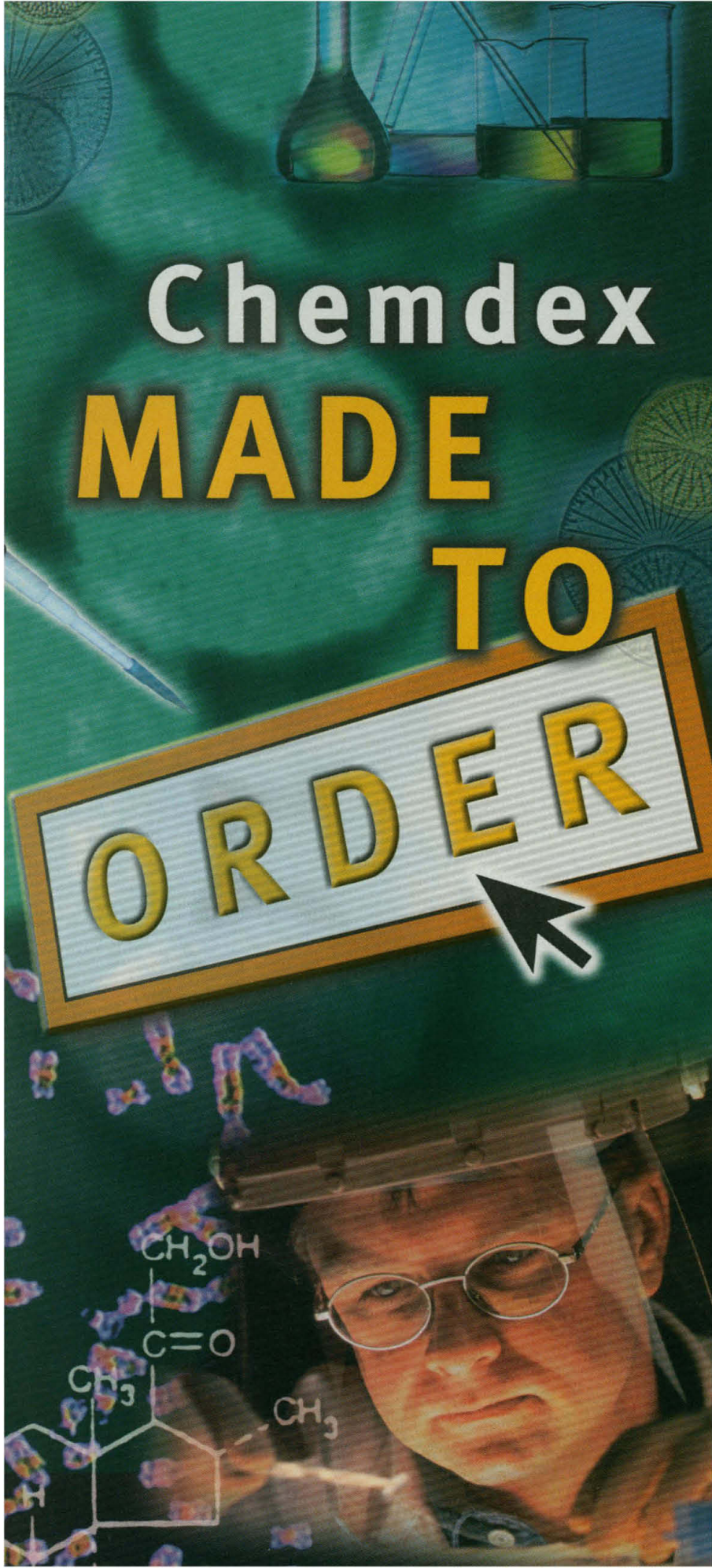
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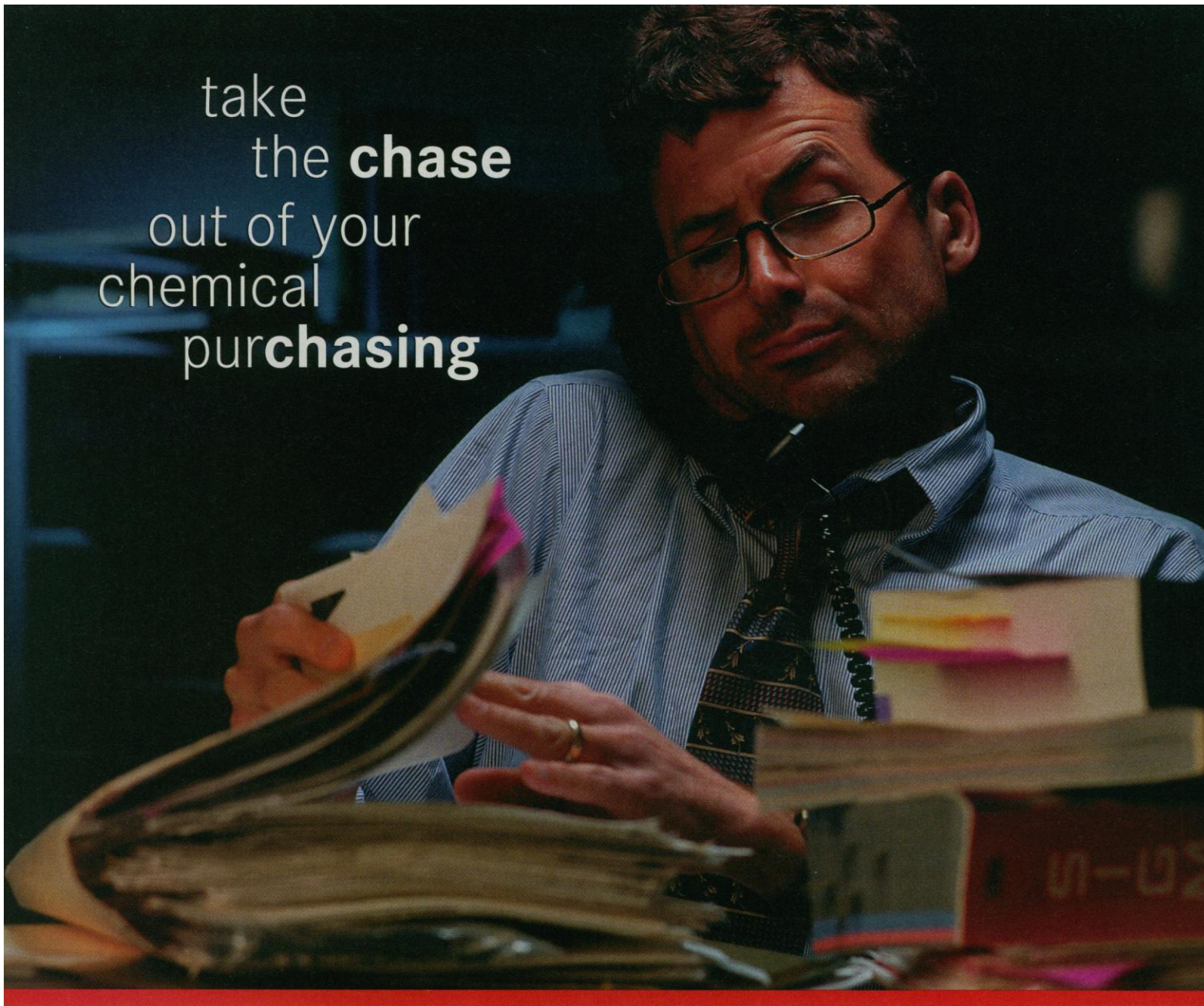


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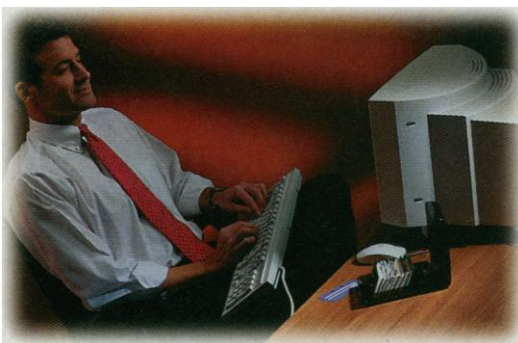
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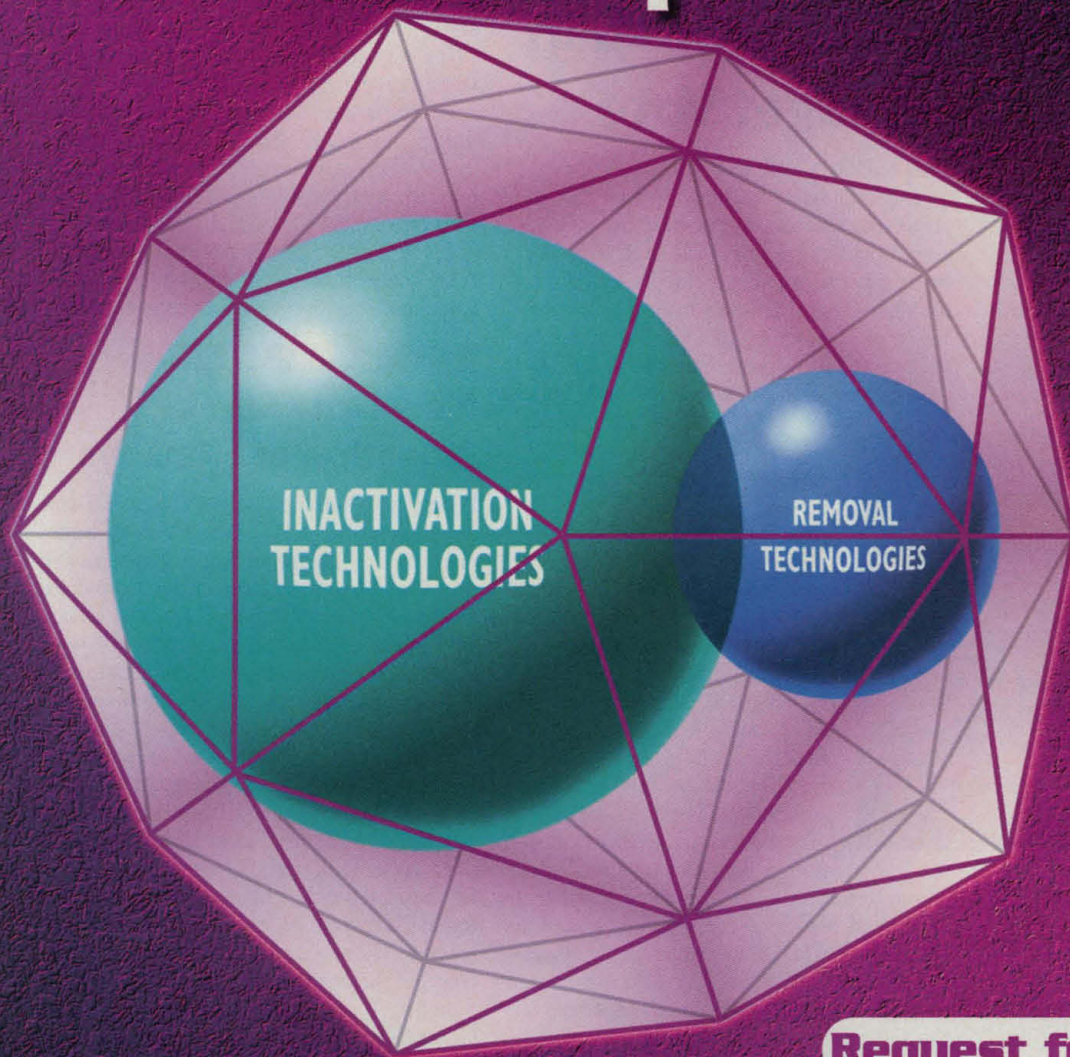


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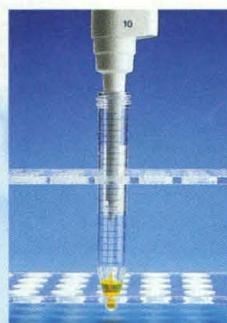
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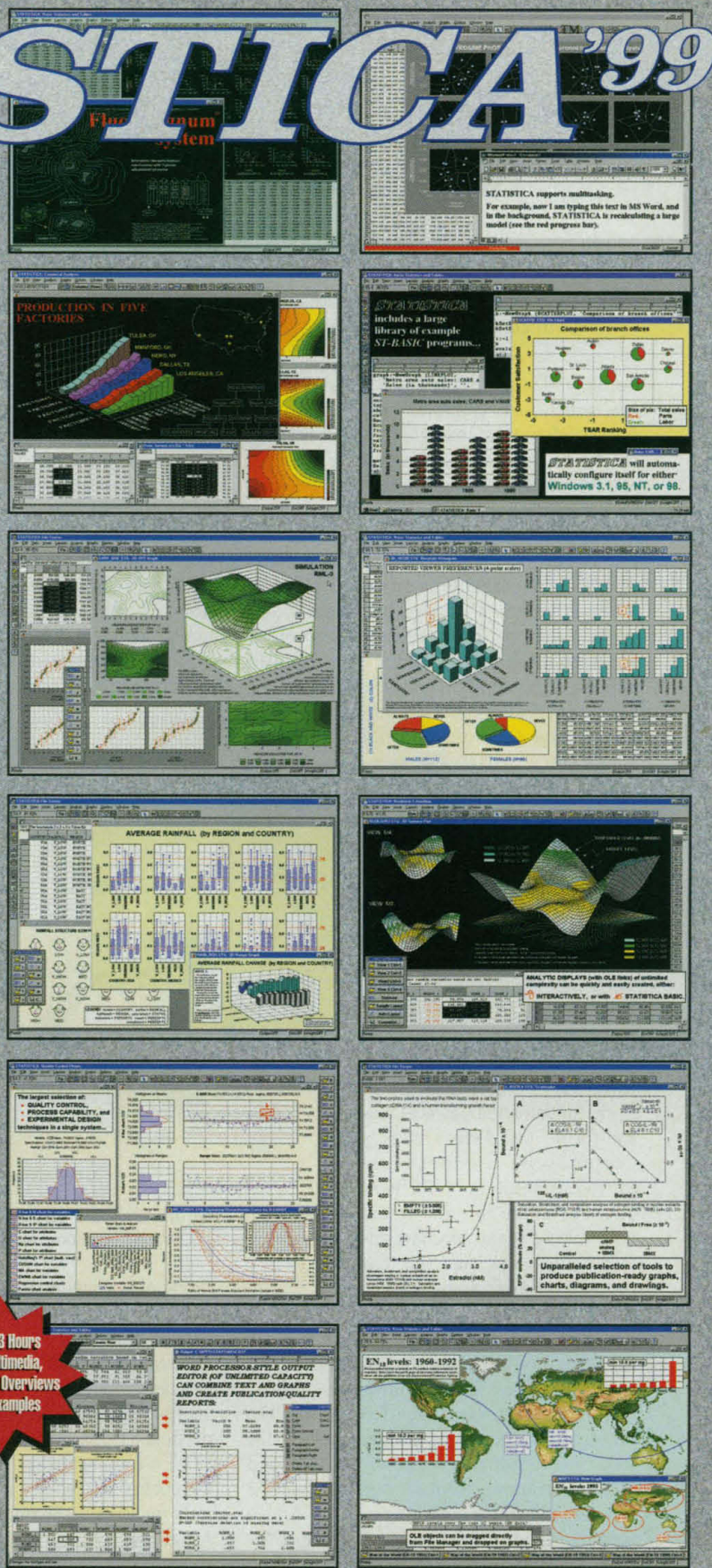
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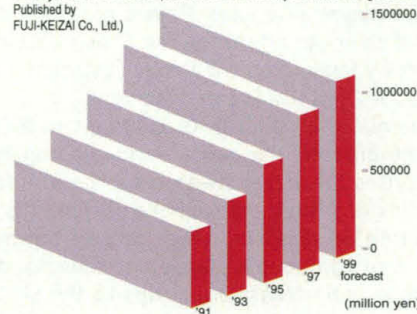
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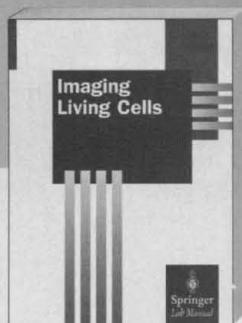
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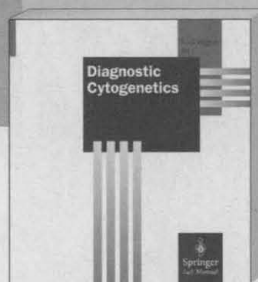
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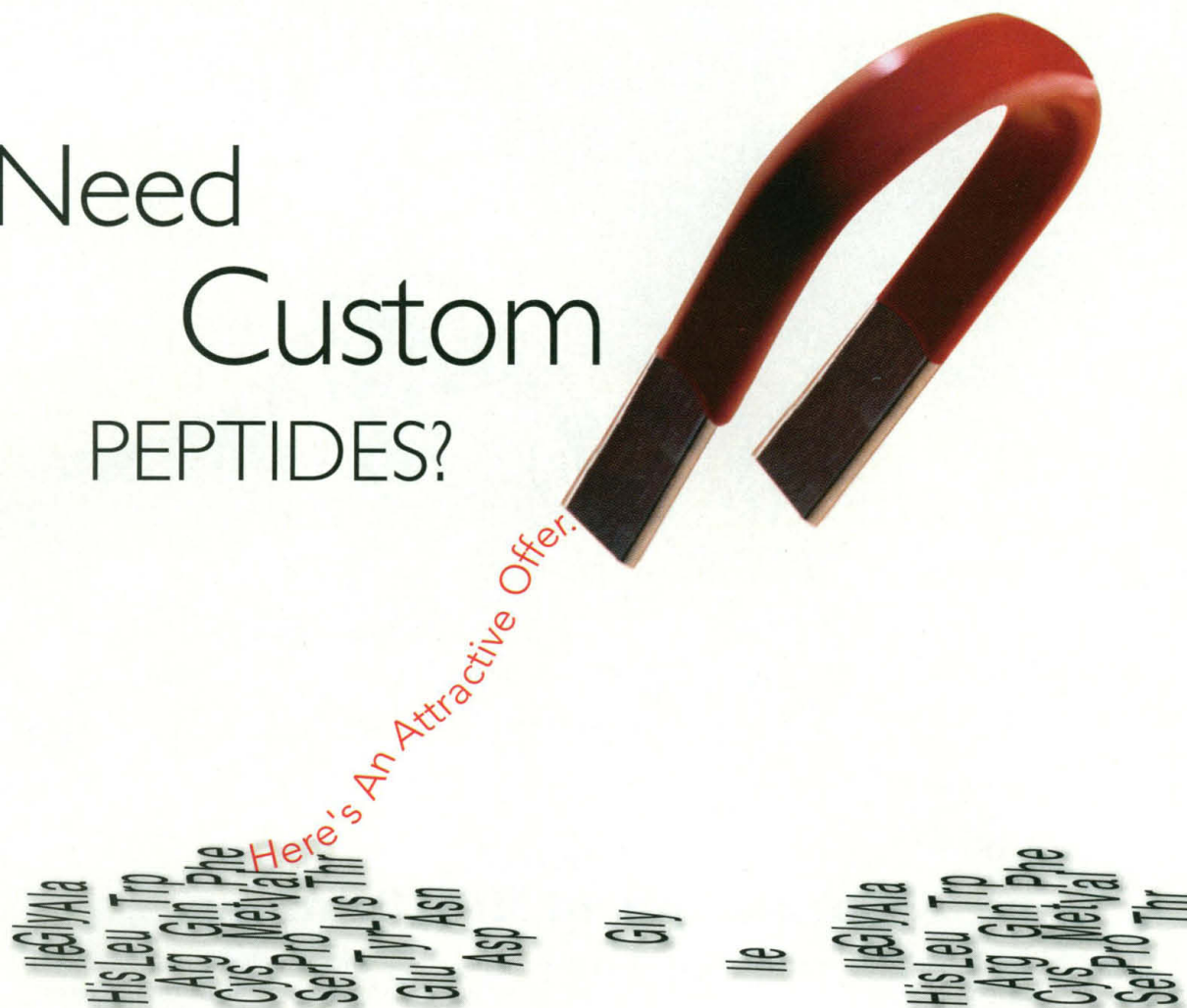
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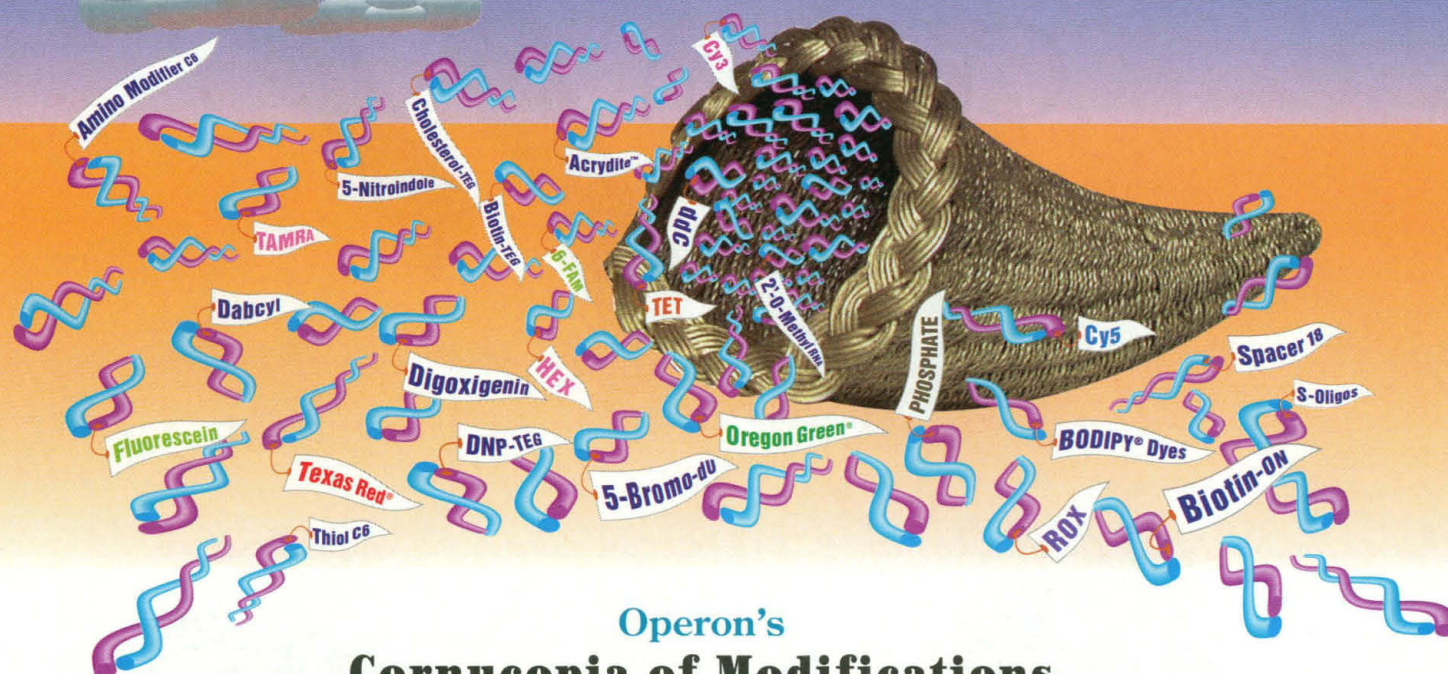
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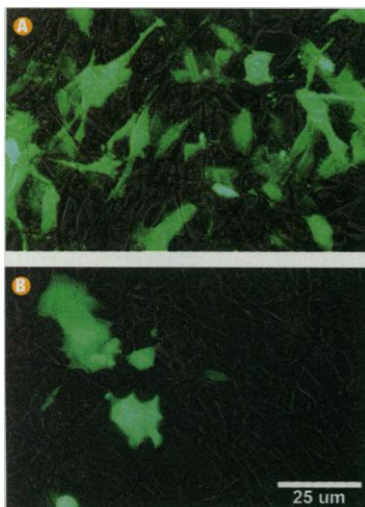
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