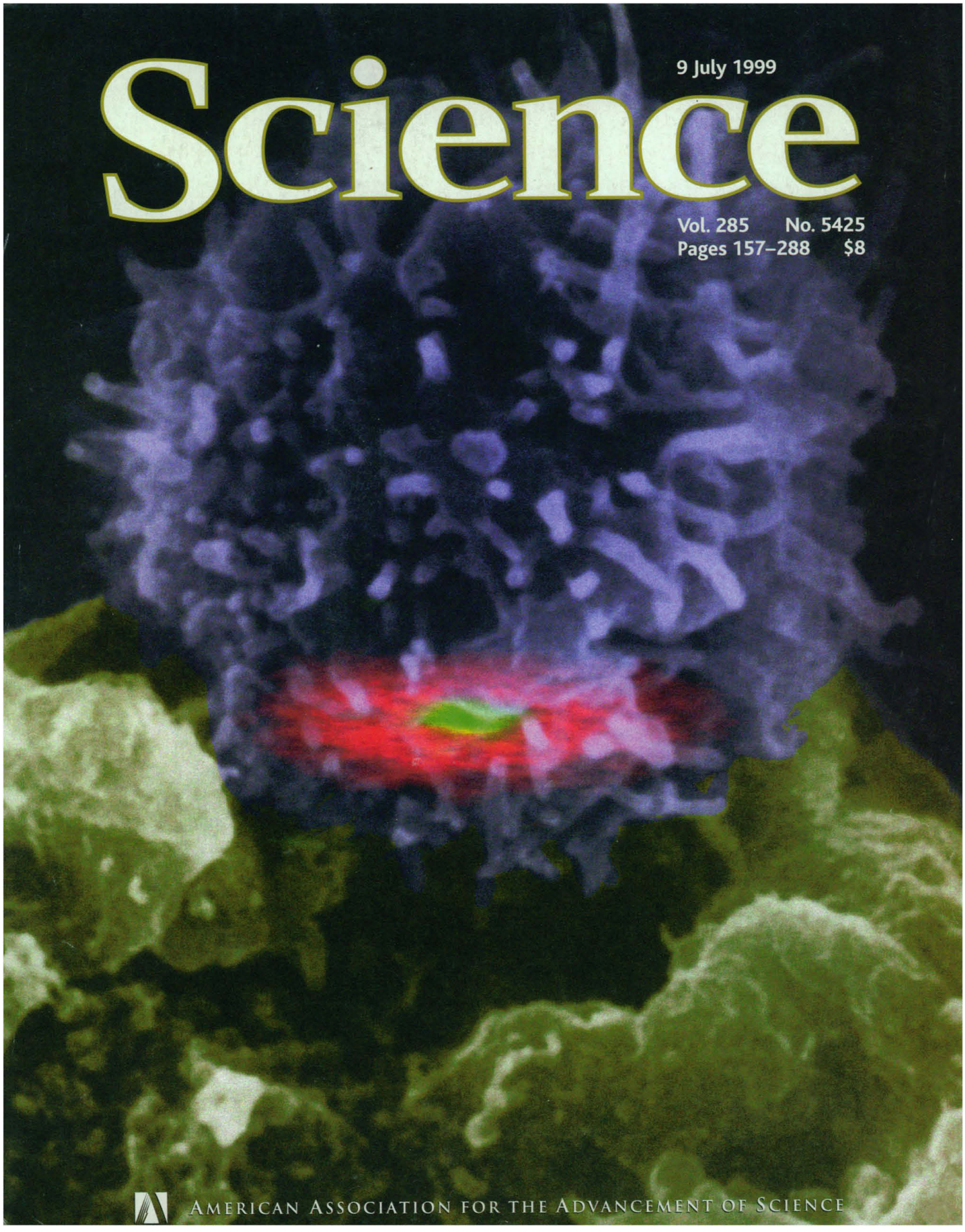

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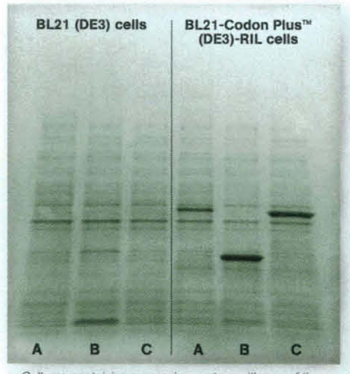

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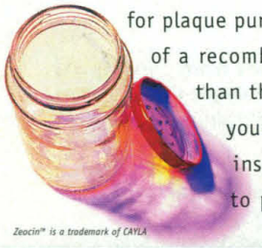

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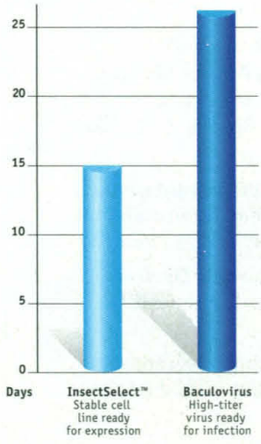

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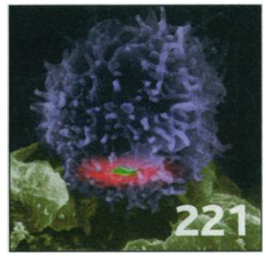
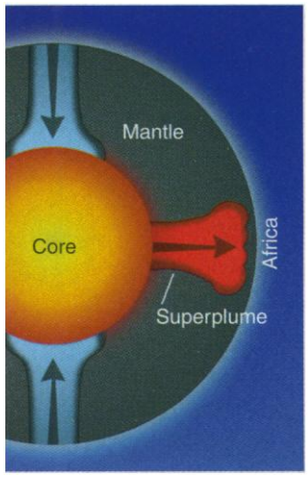


COVER Immunological synapse formation. An electron micrograph (EM) was merged with a live-cell fluorescence micrograph (FM) to show this key event in T cell activation. The immunological synapse is indicated by the bull's-eye pattern of adhesion molecules (red) and antigen receptors (green) at the interface between a T lymphocyte (~7 μm) (purple) and a dendritic cell (dark green). [Images: EM, reprinted by permission of Wiley-Liss, a subsidiary of John Wiley & Sons, Inc. ©1993 Setum *et al.*, *Anatomical Record*, **235**, p. 285; FM, M. L. Dustin]



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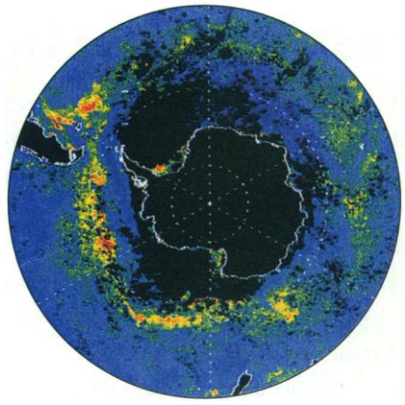

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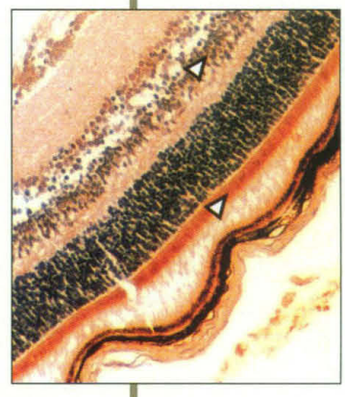
Keeping an eye on angiogenesis



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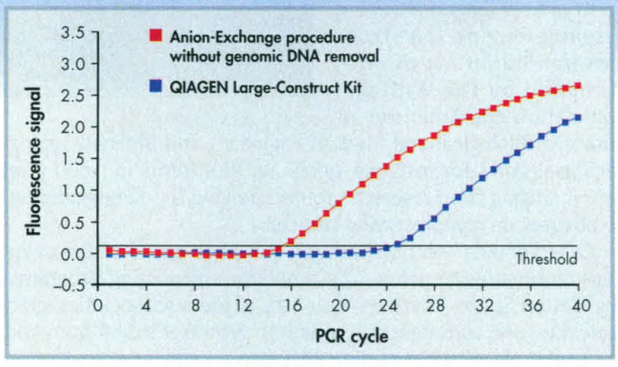

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LIGHTING THE WAY TO ORGANIC OPTOELECTRONICS

The use of polymers in electronics and optics provides benefits of low-cost fabrication and flexibility on a variety of substrate materials. However, integration of these fields has been hampered because of the inability to make polymers that have both good semiconducting character and good optical properties. By varying the proportion of cationic silica nanoparticles in the polymer host to control the bulk refractive index, Ho *et al.* (p. 233; see the Perspective by Barnes and Samuel) demonstrated the ability of this technique to fabricate high-quality mirrors. They then sandwiched a lightly doped semiconducting polymer between these mirrors to form an all-organic microcavity light-emitting diode.

FAULTY FLUIDS

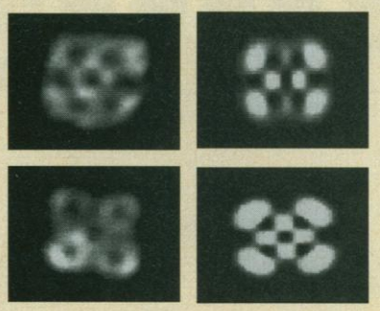
The San Andreas Fault System (SAFS) in southern California consists of the San Andreas Fault, the San Jacinto Fault, and the Elsinore Fault, which parallel each other from the south to the north. These faults are weak because the maximum stresses are oriented at a high angle to the trend of the fault planes, making them more likely to slip. Hardebeck and Hauksson (p. 236) determined the orientation of the maximum horizontal stress along the SAFS and concluded that the faults were weak at both narrow (about 2 km) and wide zones (about 50 km) around the fault planes and that these zones were regions of high strain accumulation. Their analysis suggests that the weakness is related to fluids trapped in these zones of the faults, possibly by the repeated fracturing and healing of the rocks, which would reduce the permeability of these zones and enhance the strain accumulation rate beyond what might be expected.

A GLOBAL VIEW OF OCEAN CARBON

A major process in Earth's carbon cycle is the sinking of particulate organic carbon (POC) from the surface ocean, some of which accumulates on the sea floor and is eventually buried. It has been difficult to estimate this flux locally and, even more so, globally because POC is not simply related to the amount of primary carbon production. Stramski *et al.* (p. 239) now show that POC can be estimated by satellite-based measurement of particulate backscattering. They see a large seasonal variation in POC in the Southern Ocean; such variations may allow an estimation of the removal of carbon from the oceans on a global scale.

COMPLEX NONLINEAR LASER PATTERNS

The intensity pattern of a laser beam may propagate nonlinearly and develop patterns of high and low intensity that vary with time, but producing such patterns has been experimentally challenging. Scheuer and Orenstein



(p. 230) show that broad-area vertical-cavity semiconductor lasers can be used to produce highly complex patterns containing as many as 19 "dark beams" (low-intensity vortices produced around singularities in the electromagnetic field) that can be varied simply by changing the injection current into the semiconductor cavity. These patterns do not represent beams at different infrared frequencies, but are single-frequency modes produced by locking nearly degenerate modes through the nonlinearity of the laser.

IMMUNOLOGICAL SYNAPSE FORMATION

T cells and antigen-presenting cells form specific contacts, in which T cell antigen receptors (TCRs) segregate to the center of the contact region and the larger adhesion molecules form a concentric ring. Grakoui *et al.* (p. 221; see the Perspective by Malissen) have developed a system in which they can quantify the formation of these "immunological synapses" in live cells. They have identified a multistep process for immunological synapse formation and determined how it affects T cell activation. Formation occurred after adhesion molecule engagement and initial TCR engagement outside the adhesion ring. Then TCRs migrated to the center of the adhesion ring. The last stage was the "locking in" of the central TCR clusters. The stability of the central cluster contributed to overall stability of the synapse and was sensitive to a threshold determined by the strength and number of the TCRs that interacted with peptide class I major histocompatibility proteins.

CELLULAR DELIVERY ZONES

The process by which eukaryotic cells take up macromolecules, called endocytosis, begins at a specialized region at the plasma membrane that appears as an invagination. This "pit" is coated on its cytosolic surface by a complex of proteins called the clathrin coat. The clathrin-coated pit eventually pinches off to become an intracellular coated vesicle. Marsh and McMahon (p. 215) review the model that has emerged from recent structural analysis of the coat complex, which has become much more complicated than was first envisioned.

EYE-CATCHING ANGIOGENESIS INHIBITOR

Proper functioning of the mammalian eye depends on the exclusion of blood vessels from the cornea. Dawson *et al.* (p. 245) show that this exclusion is due, at least in part, to retinal pigment epithelium-derived factor (PEDF), one of the most potent angiogenesis inhibitors identified to date. These results suggest that PEDF, a protein previously shown to have neurotrophic activity, may have therapeutic applications in eye diseases where pathological angiogenesis compromises vision.

LATE BUT LETHAL MEDIATOR

Endotoxin, a constituent of all Gram-negative bacteria, stimulates macrophages to release large quantities of tumor necrosis factor (TNF) and interleukin-1 (IL-1), which can precipitate lethal shock. In experiments with a mouse model, Wang *et al.* (p. 248) showed that high mobility group–1 (HMG-1) protein, a factor previously studied in the context of transcription, may be another mediator of endotoxin lethality. In contrast to the early mediators TNF and IL-1, HMG-1 is released from macrophages late after endotoxin exposure. Antibodies to HMG-1 attenuated the lethality of endotoxin in mice. Serum levels of HMG-1 were elevated in patients with lethal bacterial infections, suggesting that the protein may play a similar pathogenic role in humans.

CONTINUED ON PAGE 167

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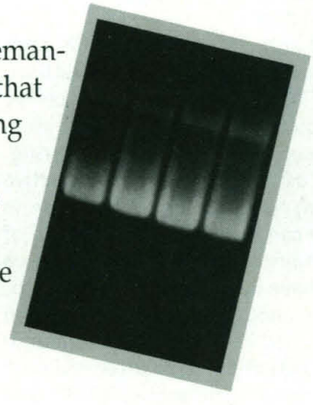

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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 165

QUANTITY AND QUALITY

Changes in the number of sets of chromosomes (ploidy) have been associated with processes as diverse as sexual reproduction, tumor progression, and evolution of species. An unanswered question has been whether such changes are merely a consequence of other events or whether increases or decreases in the total chromosome number (n) can trigger changes in gene expression. Galitski *et al.* (p. 251; see Perspective by Hieter and Griffiths) have constructed strains of the yeast *Saccharomyces cerevisiae* that vary in chromosome number from n to 4n. Microarray analysis revealed a subset of genes that showed ploidy-dependent expression. In some cases, the data can be used to explain biological phenomena; for example, ploidy-dependent repression of cyclins may be responsible for the greater cell size associated with higher ploidy.

REACHING OUR GOALS

Much of the central nervous system is devoted to processing sensory input and to computing motor output. For example, the color, shape, and location of a low-hanging apple are decoded in the early stages of the visual processing pathway in the brain, and the appropriate spatial and temporal activation of muscles that move the arm and hand toward that apple are controlled by the motor cortical region. How is the visual information—spatially coded by the retina in eye-centered coordinates—transferred to the motor system, where arm movements are thought to be coded in limb-centered coordinates? Batista *et al.* (p. 257; see the news story by Barinaga) uncover one of the steps in this transformation by finding that neurons active during the planning stage of the reach movement encode the target of the reach in eye-centered coordinates. Making plans within the visual coordinate frame may occur because we often focus on objects of desire (that is, moving our eyes toward the target) and we often make compensating corrections (that are based on visual estimation) during the actual reach movement.

STICKING TOGETHER

Proper chromosome transmission requires the cohesion of replicated chromosomes, called sister chromatids. To identify chromosomal segments required for chromatid cohesion, Megee and Koshland (p. 254) developed a functional assay using yeast circular minichromosomes. They found that cohesion is mediated in part by a centromeric DNA element that overlaps with sequences required for assembly of the kinetochore, the protein complex that mediates binding of spindle microtubules. Application of the assay to kinetochore protein mutants will allow direct assessment of the roles these proteins might play in cohesion.

NATURAL SUNBLOCK

Xeroderma pigmentosum (XP) patients are hypersensitive to sunlight and develop skin cancer at a high frequency. Most XP patients harbor mutations that lead to defects in nucleotide excision repair of ultraviolet-damaged DNA; however, about 25% (the variant form of XP; XP-V) have normal nucleotide excision repair function. Johnson *et al.* (p. 263; see the Perspective by Cleaver) identify the gene responsible for XP-V as the human homolog of yeast *RAD30*, which encodes a DNA polymerase involved in error-free replication of ultraviolet-damaged DNA. This finding suggests that normal human *RAD30* function is important in minimizing the incidence of skin cancer.

TECHNICAL COMMENT SUMMARIES

STAT Genes Found in *C. elegans*

The full text of these comments can be **seen at** www.sciencemag.org/cgi/content/full/285/5425/**167a**

G. Ruvkun and O. Hobert (Review, 11 Dec., p. 2033) surveyed the genome sequence of *Caenorhabditis elegans* for transcription factor and signaling gene families that have been shown to regulate development in a variety of species. One finding was that "only a very distant partial STAT gene [is] present in *C. elegans*."

X. Liu *et al.* comment that their search of the database found STAT-like sequences in *C. elegans*, which they designate as *ce-stat-a* and *c-stat-b*. They provide a figure showing functional domain sequences of the former.

In response, Ruvkun and Hobert state that "Liu *et al.* are correct in amending one point (among 589 such points)" in the analysis in the Review. They state, "We would expect that perhaps one or two more missing genes will emerge when the genome sequence is complete."

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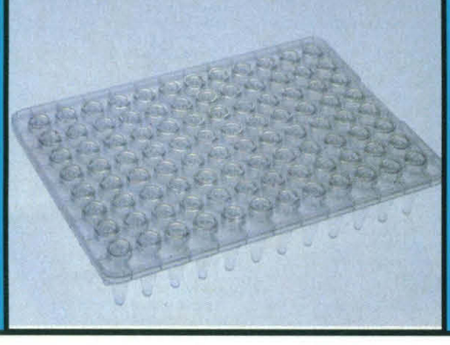

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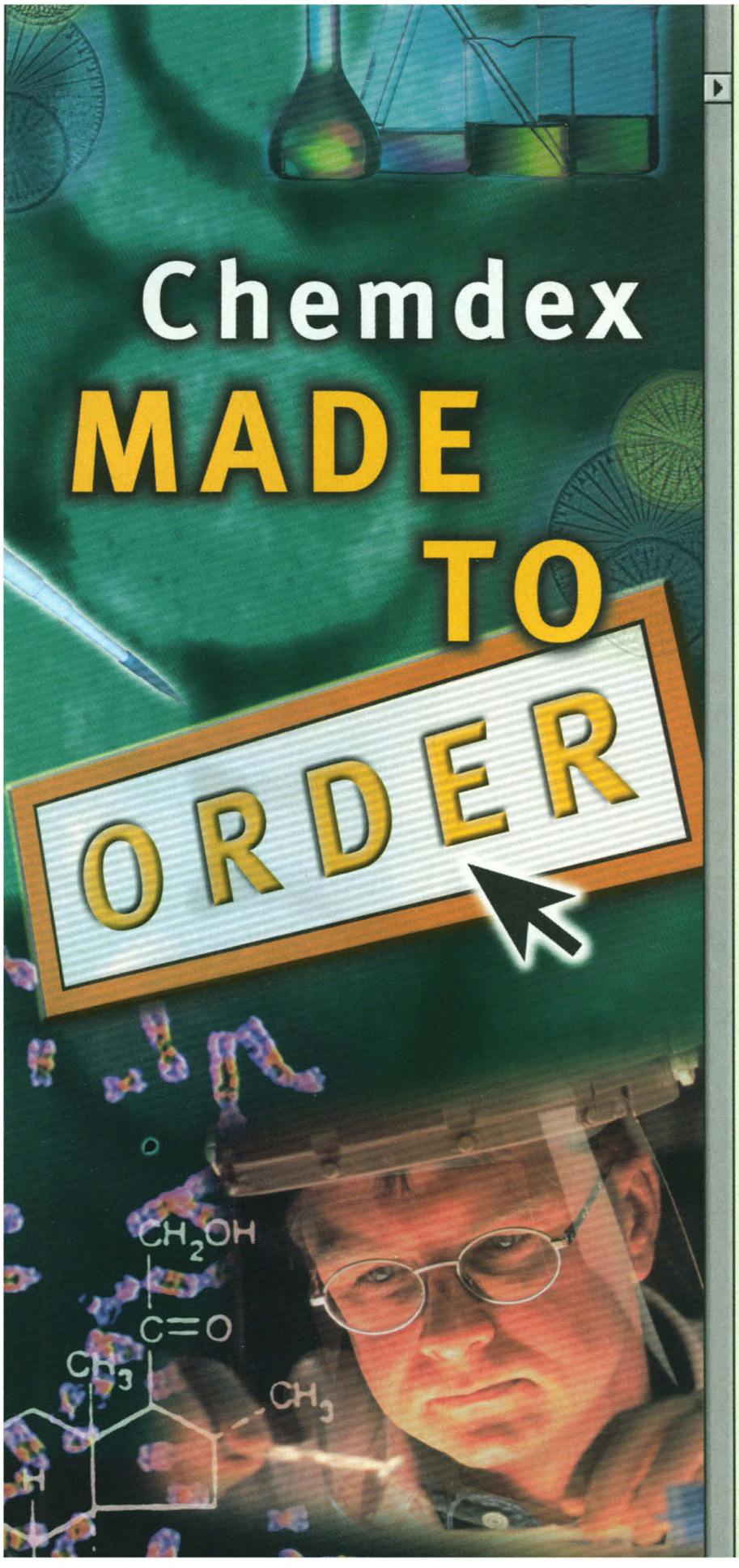

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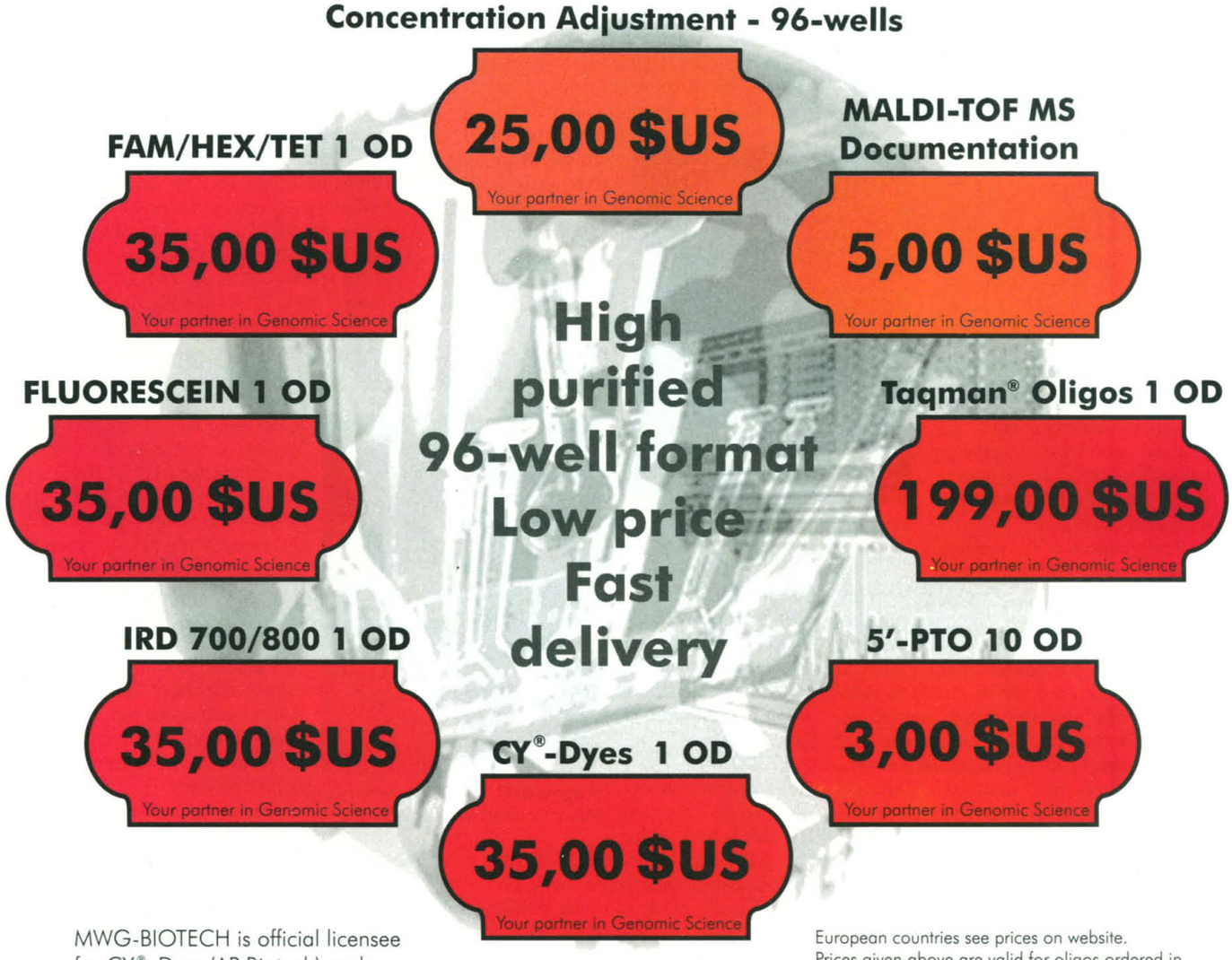

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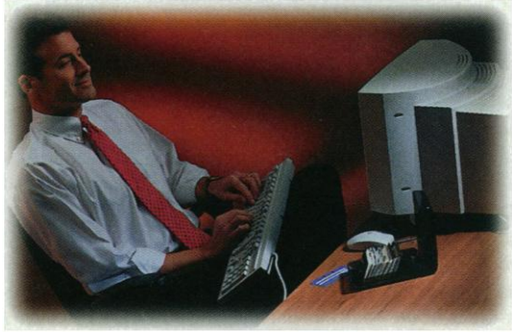

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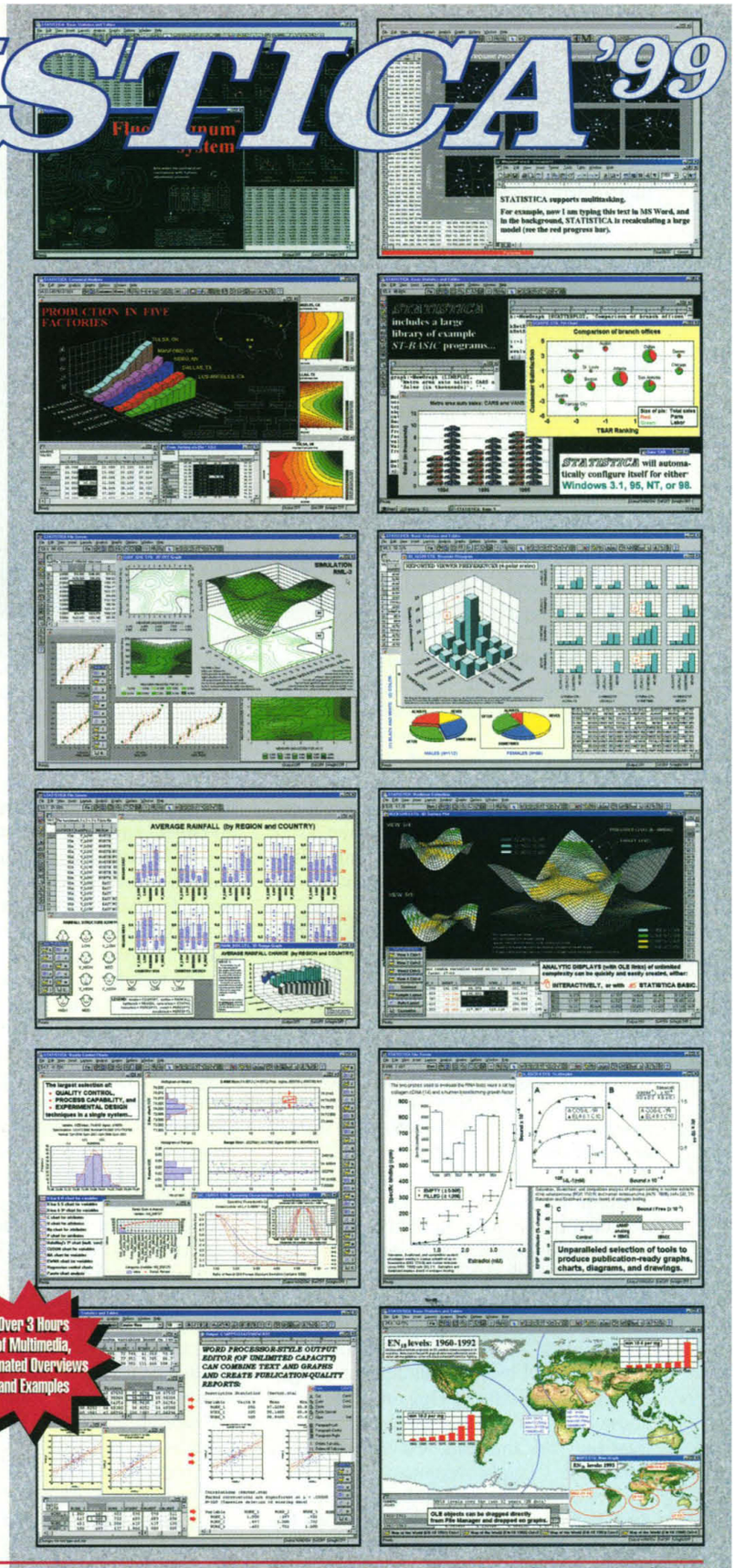

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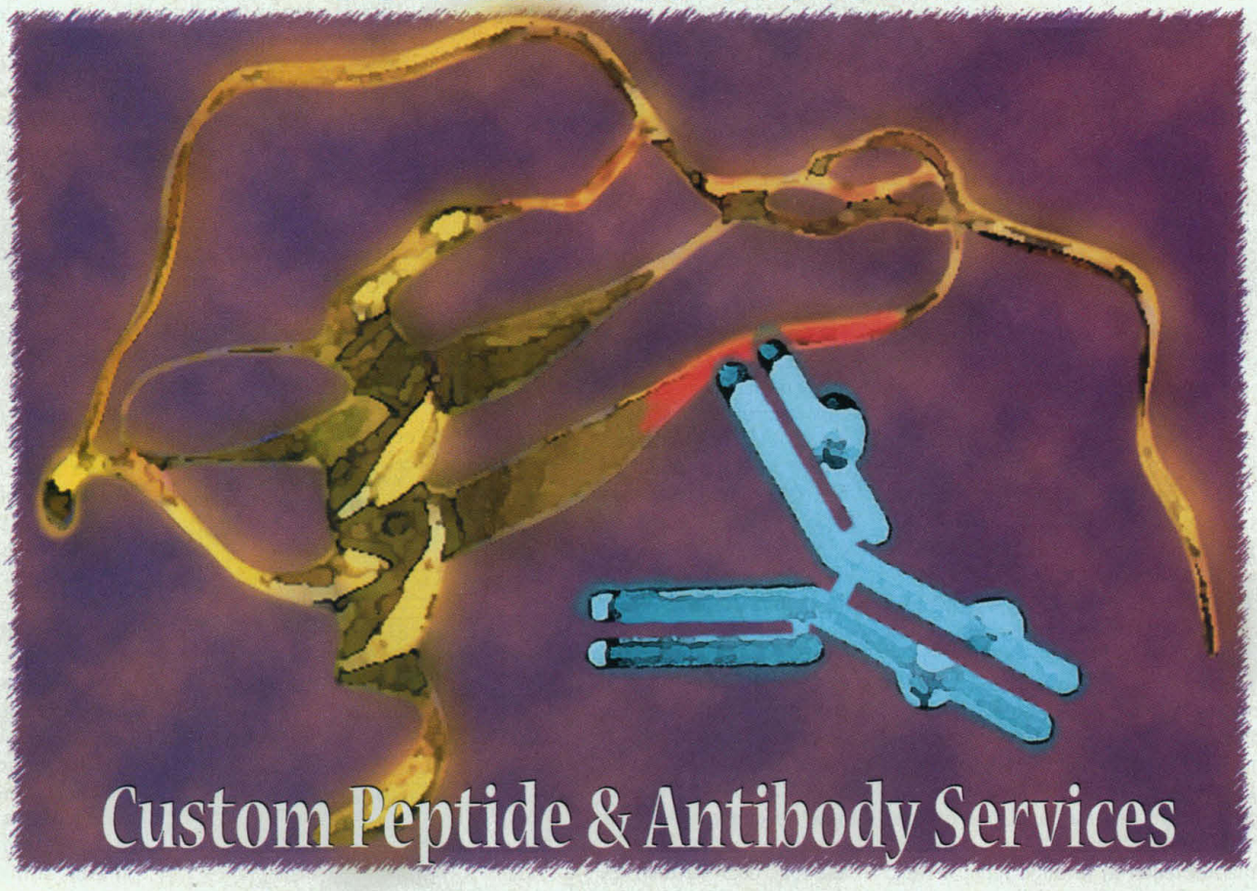

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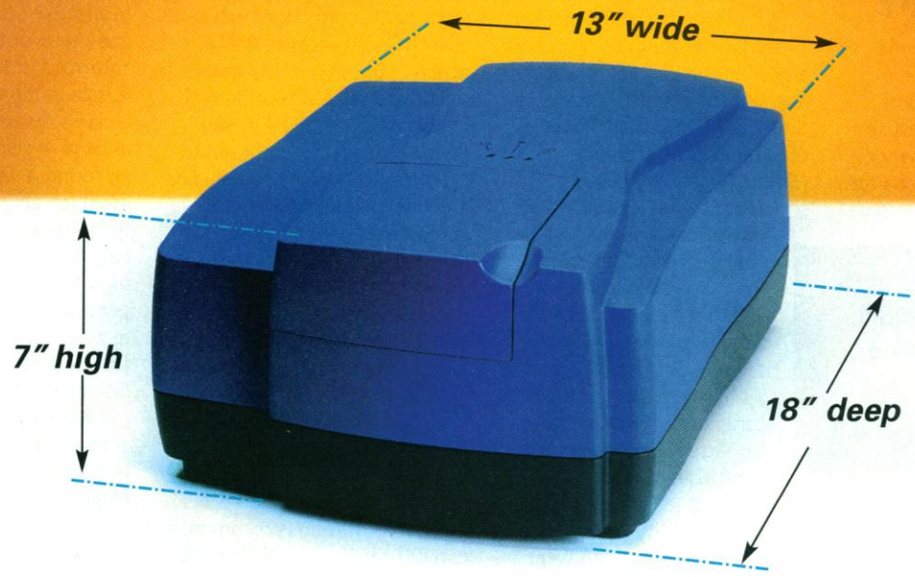

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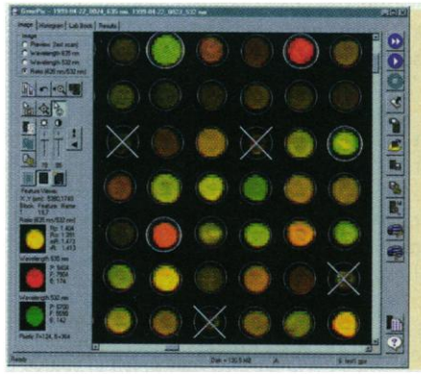

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