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2 October 1998

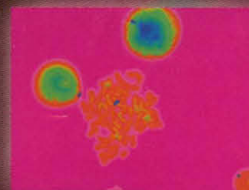
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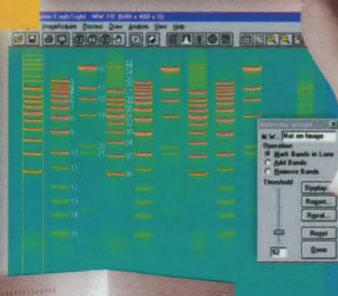
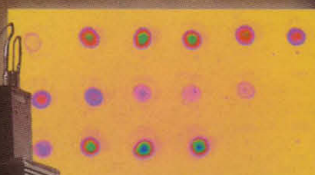
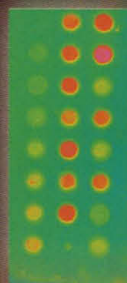
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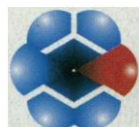
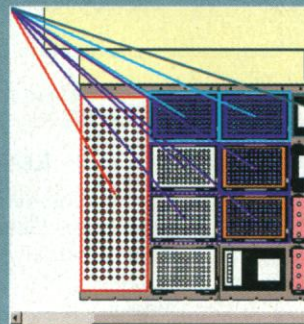
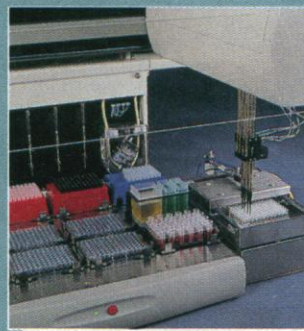
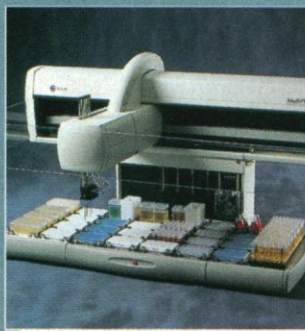
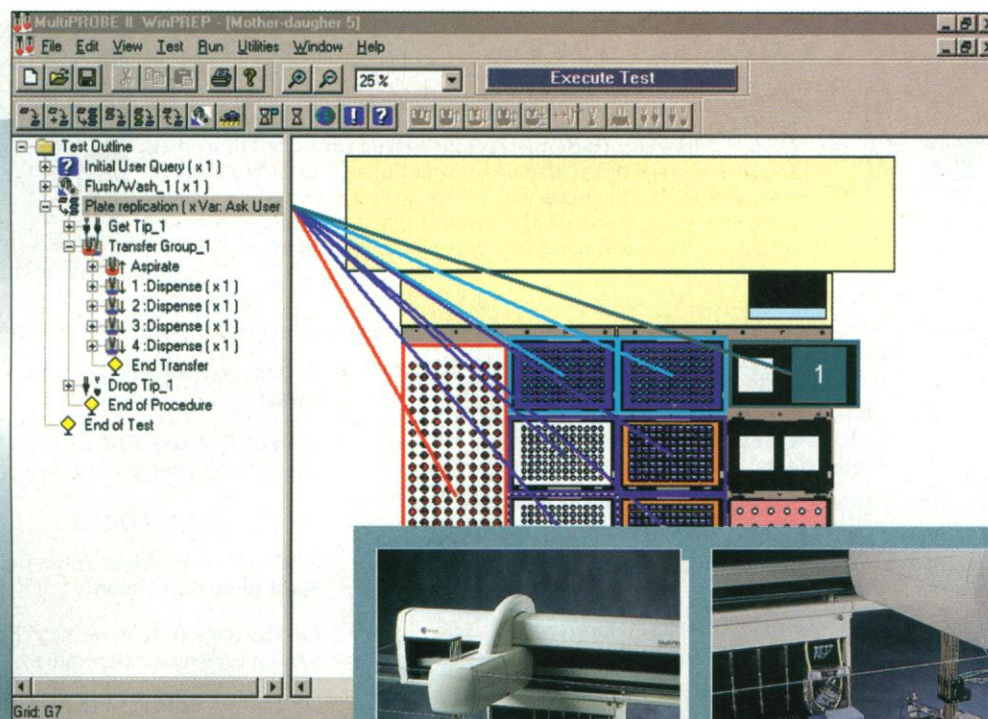
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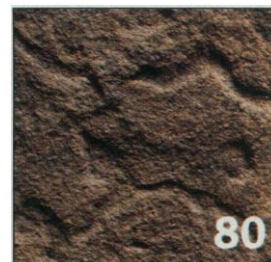
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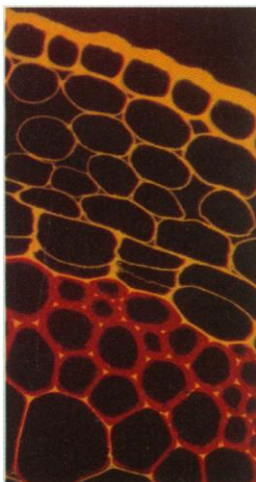
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Cover Assumed worm burrows in a 1.1-billion-year-old sandstone from central India. These trace fossils extend the record of animals to twice the age of the Cambrian evolutionary explosion. The burrows (~3 to 4 millimeters wide) were probably made in a shallow sea underneath a microbially bound surface mat, and weathering of the mat layer was necessary to reveal them. [Photo: W. K. Sacco]



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More than scaffolding

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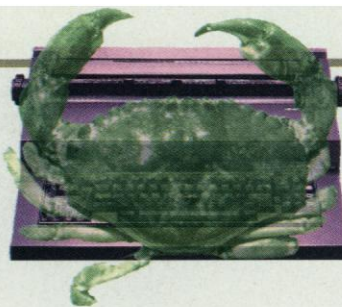
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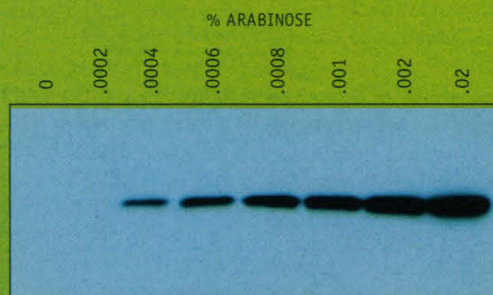
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TRACES OF ANCIENT ANIMALS

Did some animals arise well before the fabled Cambrian explosion about 540 million years ago? Some small fossils have been found that indicate a slightly earlier origin, but earlier fossil remains have been lacking, and many claims for an earlier origin have been equivocal or discounted. Seilacher *et al.* (p. 80; see the cover and news story by Kerr) now describe structures preserved on bedding planes in the Chorhat Sandstone of India that appear to be trace fossils—burrows left from a worm's movements. These rocks are about 1 billion years old, and the authors suggest that the traces formed as the animal burrowed along under an algal mat.

CAUGHT IN FULL FLIGHT

An important question in marine atmospheric chemistry relates to the nucleation conditions for very small aerosol particles. Such particles may play an important role in cloud formation as cloud condensation nuclei, and it is important to find out where and how new particles are formed. Clarke *et al.* (p. 89) have made airborne measurements that allow the direct observation of nucleation events in the marine boundary layer, thus constraining the conditions required for such events to take place. The results also provide further insights into the limitations of the current theoretical understanding of particle nucleation.

SYNCHRONICITY AT THE POLES

Major paleoclimate climate changes—such as ice ages—may be in or out of phase between the Northern and the Southern Hemispheres. Evidence from several ice cores from Greenland and Antarctica has pointed toward an asynchronous response. Steig *et al.* (p. 92; see the Perspective by Stocker) report data from a different Antarctic ice core for the last 20,000 years. They find that the most prominent North Atlantic events during this time are also recorded synchronously in this core. Thus, the patterns of climate change in and around Antarctica are regionally heterogeneous and more complex than previously thought. Such effects have also been observed in models.

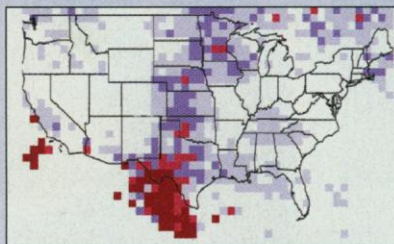
POINTING OUT SPIN POLARIZATION

An emerging class of devices, such as spin valves, is based on the spin rather than the charge of electrons. Soulen *et al.* (p. 85) report a simple method for measuring the spin polarization (the ratio of up and

down spins) of metals, including materials, such as chromium dioxide, that have been difficult to measure by other methods. A tip of a superconductor, such as niobium, forms a point contact with the metal. The conversion of supercurrent (electron pairs) to normal current at cryogenic temperatures will depend on the population of the minority spins in the metal near its Fermi surface.

SMOKED LIGHTNING

Most cloud-to-ground lightning (almost 90%) has a negative polarity; the causes of this difference and the processes of charging in thunderstorms are poorly known. Lyons *et al.* (p. 77; see the news story by Irion) show, however, that from April to June 1998, storms over the central United States had much greater proportions



of positive charges, up to 59% in one storm. The authors associate this change with the influx into the region of considerable smoke from forest fires in Mexico, which evidently altered the charging in the storms.

AMMONIA AT AMBIENT PRESSURES

An early triumph of industrial chemistry was the Haber synthesis of ammonia; iron catalysts allow the reaction to proceed at moderate temperatures (430° to 480° Celsius), but high pressures (150 to 300 atmospheres) that favor product formation are needed. Marnellos and Stoukides (p. 98) have synthesized ammonia from hydrogen and nitrogen at ambient pressures and somewhat higher temperatures (570° Celsius) in an electrochemical cell. Hydrogen is dissociated at a palladium anode and delivered through a proton-conducting ceramic tube (a strontia-ceria-yttria perovskite) to react with nitrogen at a palladium cathode. In this system, electrical work rather than pressure drives the reaction, which converts almost 80% of the protons delivered into ammonia.

SOLUBLE NANOTUBES

Carbon nanotube chemistry and spectroscopy have been limited by their lack of solubility in organic solvents. Chen *et al.* (p. 95) have derivatized the ends of purified and shortened single-walled carbon nanotubes (SWNTs, 100 to 300 nanometers in length) by heating them for 1 day with SOCl₂ and in octadecylamine for 6 days. The resulting nanotubes are soluble in many common organic solvents, and spectroscopic studies allowed the band gaps of undoped and iodine- and bromine-doped SWNTs to be measured. The authors were also able to derivatize the walls of the SWNTs and found that saturation of just 2% of the wall carbon atoms could lead to large changes in the electronic band structure.

THE LATEST SPIN ON BROWN DWARFS

Brown dwarfs are dim objects that are more massive than planets, but not massive enough to maintain nuclear fusion in their cores and burn as brightly as stars. Since 1995, unambiguous detections of brown dwarfs have started to account for some of the missing mass in the universe and provide more details about this once missing link between planets and stars. Neuhauser and Comerón (p. 83; see the news story by Schilling) have used the Röntgen Satellite to detect x-ray emission from a very young, very low mass brown dwarf (Cha H α 1) in the Chamaeleon I star-forming cloud. They believe that this x-ray emission is related to convection within Cha H α 1 or rotation of the brown dwarf. Like some low-mass young stars, fast rotation would create a dynamo and maintain a magnetic corona.

MICROBIAL ENZYME MODULES

Microbial organisms synthesize an extraordinary variety of medically important molecules, such as erythromycin, penicillin, and cyclosporin. These molecules are built from simple monomers of carboxylic acids or amino acids by modular enzyme complexes. Cane *et al.* (p. 63) review recent advances in understanding how these complexes work and future approaches to manipulating the modules to expand the molecular repertoire.

COLD-TOLERANT CARROTS

Subfreezing temperatures have devastating effects on certain plants, whereas others are more tolerant. Worrall *et al.* (p. 115) have isolated a protein from the

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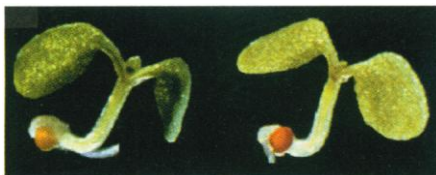
THIS WEEK IN SCIENCE

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carrot that limits the growth of ice crystals, thus limiting the damage done by cold temperatures. As with antifreeze proteins identified from animals, the carrot protein contains repeated sequences.

IMPORT INTO CHLOROPLASTS

Many of the proteins found inside chloroplasts are transcribed from genes that reside in the nucleus. Importing such proteins into the plastid compartments is in part the function of translocon complexes



in the chloroplast membrane. Jarvis *et al.* (p. 100) have identified the gene for one of the components of chloroplast translocons in the plant *Arabidopsis*. Similarities to related proteins suggest that there may be more than one type of translocon, perhaps with differentiated functions.

HOLDING OUR GAZE

We are continually bombarded with numerous visual stimuli, like fans clamoring for an autograph, some of which seem to be relegated automatically to the background and some of which capture our attention. How is this selection made? Kastner *et al.* (p. 108; see the Perspective by Kanwisher and Downing) provide brain imaging results from human subjects in support of the proposal that selection is an active process. When we are not actively attending to a particular item in our field of view, multiple items compete with each other, yielding an overall suppression of neuronal activity that any of these items would evoke on its own. When we focus our attention, the result is to counteract this suppressive effect, thus sharpening the overall neuronal response so as to highlight the item of interest.

THE EYES HAVE IT, TOO

Detection of light by the eye occurs through a process in which the light receptor of rhodopsin activates a heterotrimeric guanine nucleotide-binding protein (G protein) called transducin. Transducin regulates the enzyme guanosine 3',5'-monophosphate phosphodiesterase (PDE). Activation of the G protein is critical to initiation of the response, but in this and many other processes, G protein inactivation is also a crucial point of regulation.

Tsang *et al.* (p. 117) analyzed mice in which PDE γ subunit was mutated such that it no longer interacted with transducin. Inactivation of transducin was impaired even though the RGS proteins (regulators of G protein signaling), which also contribute to inactivation, were functioning normally. The results suggest a mechanism that may contribute to efficient signaling: The RGS proteins appear to only inactivate rhodopsin after the G protein has bound to (and hence activated) its target enzyme.

TELLING PAIRS APART

The four bases of DNA (A, C, G, T) each offer a distinctive array of hydrogen bond donors (N-H) and acceptors (C=O) that are used in the complementary base pairing in the DNA double helix. However, many biological events rely upon sequence-specific recognition of double-stranded DNA, and thus therapeutic design of small molecules that can distinguish base-paired bases is appealing. Kielkopf *et al.* (p. 111) present the structural basis for how a synthetic polyamide can tell the difference between a T-A base pair and an A-T pair from within the minor, narrower groove of double-helical DNA.

EFFECTS OF INTERFERON- α ON HEPATITIS C INFECTION

Although early evidence suggested that interferon- α blocks hepatitis virus from infecting cells, kinetic analyses of Neumann *et al.* (p. 103) demonstrate that it acts at the stage of production or release of virions. The authors have refined their analyses to determine virion half-life, the rate at which infected cells die, and the effects of different doses of interferon on antiviral efficacy. They suggest that more aggressive early treatment of the disease may result in more long-term success for patients.

NO ESCAPE FOR BACTERIA

Cytolytic T lymphocytes (CTLs) destroy cells that are infected by viruses or intracellular bacteria. This destruction lyses the cells but can also free the bacteria. The subset of CTLs that releases granules to kill infected cells also can damage the bacteria harbored within. Stenger *et al.* (p. 121) show that the protein granulysin, which is a component of the granule, can kill bacteria, including the mycobacteria that cause tuberculosis and hide inside cells. The identification of a natural antimicrobial contained in T cell granules identifies a mechanism that T cells use to clear intracellular pathogens.

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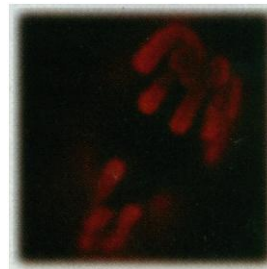
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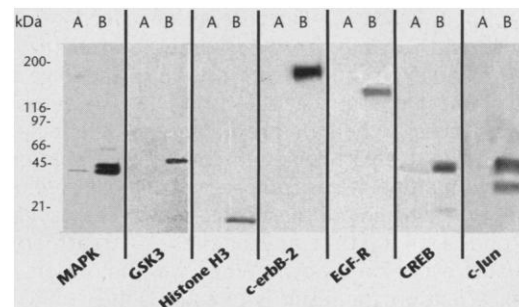
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Exponentially-growing kangaroo rat Ptk1 cells were fixed with methanol and stained with Upstate Biotechnology polyclonal anti-phospho-Histone H3 (Mitosis Marker) and visualized with a rhodamine-conjugated secondary antibody. An anaphase nucleus is shown at high magnification.



Western Blot Analysis. Lysates of unstimulated cells (Lane A) and stimulated cells (Lane B) were resolved by electrophoresis, transferred to nitrocellulose and probed with phosphorylation state-specific antibodies.

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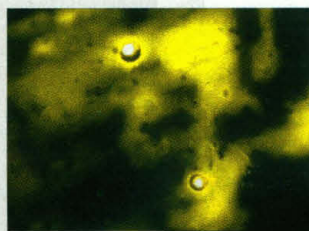
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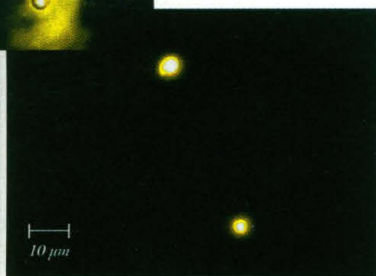
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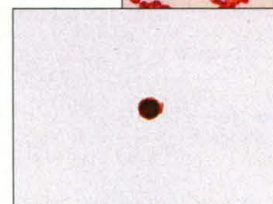


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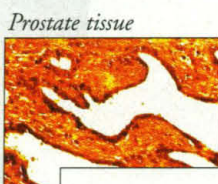
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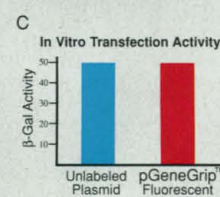
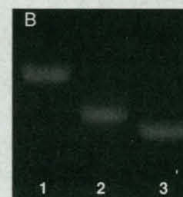
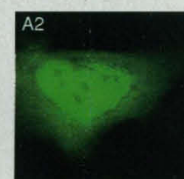
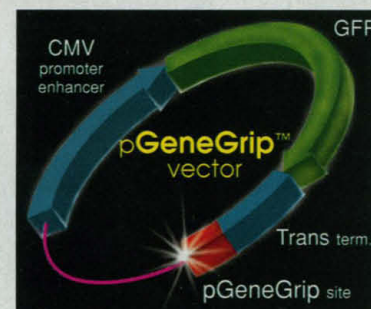
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- A.** Fibroblasts transfected with pGeneGrip™ Rhodamine/GFP vector:
1. Rhodamine labeled DNA
2. GFP expression
- B.** Electrophoresis of pGeneGrip™ Rhodamine labeled fluorescent vector
Lanes: 1. β -gal, 2. GFP, 3. Blank
- C.** Plasmid expression with and without fluorescent label.



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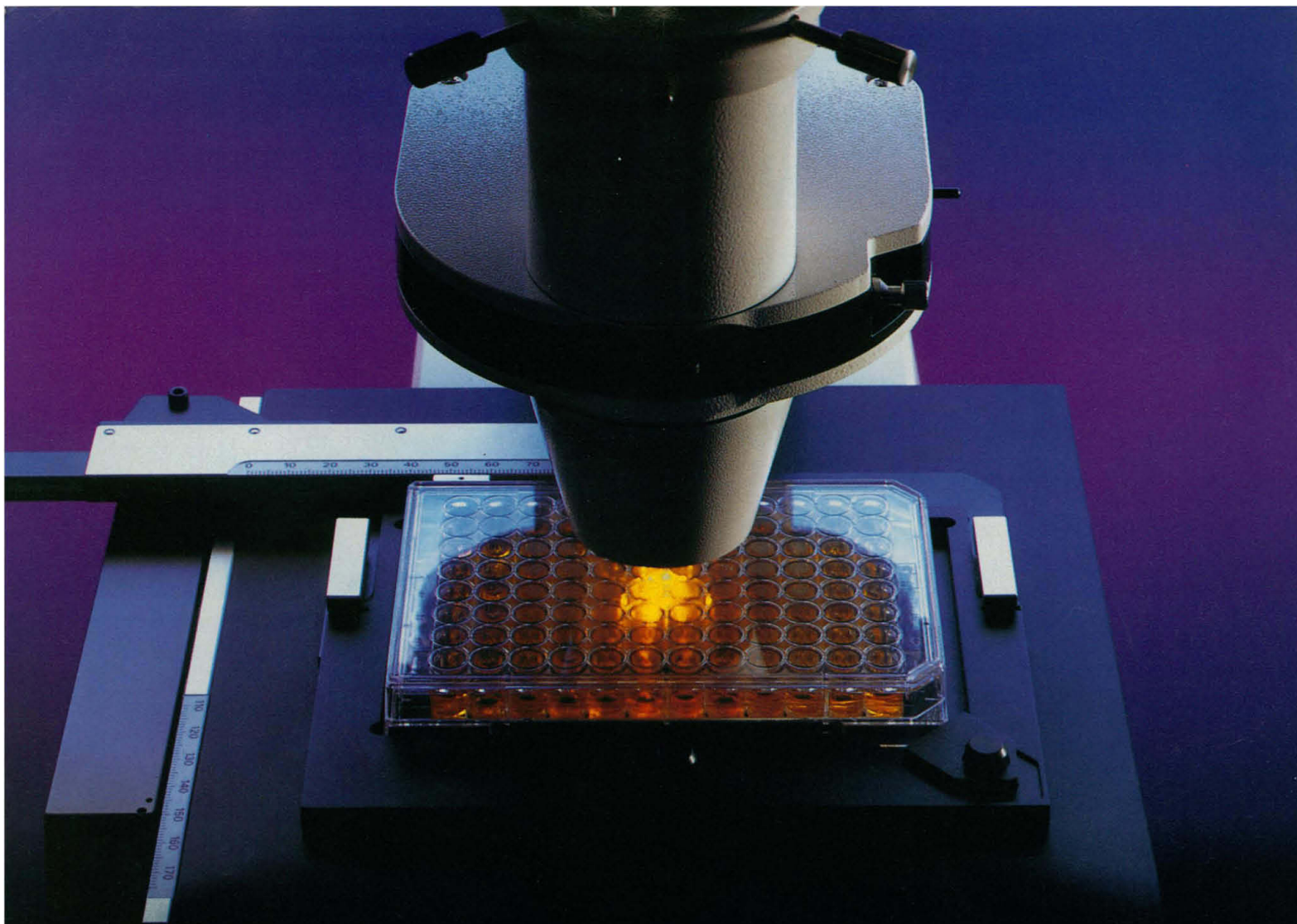
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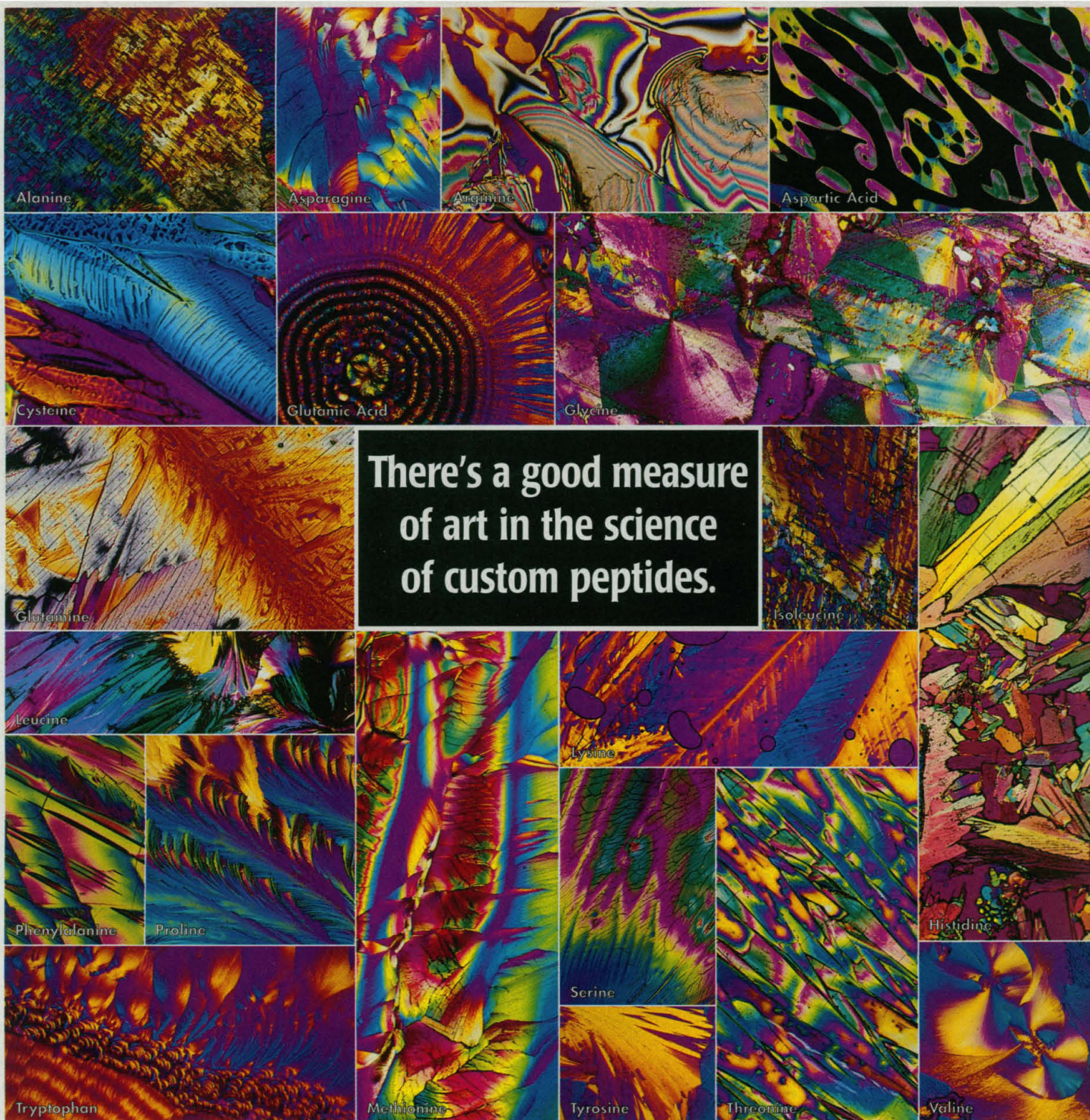
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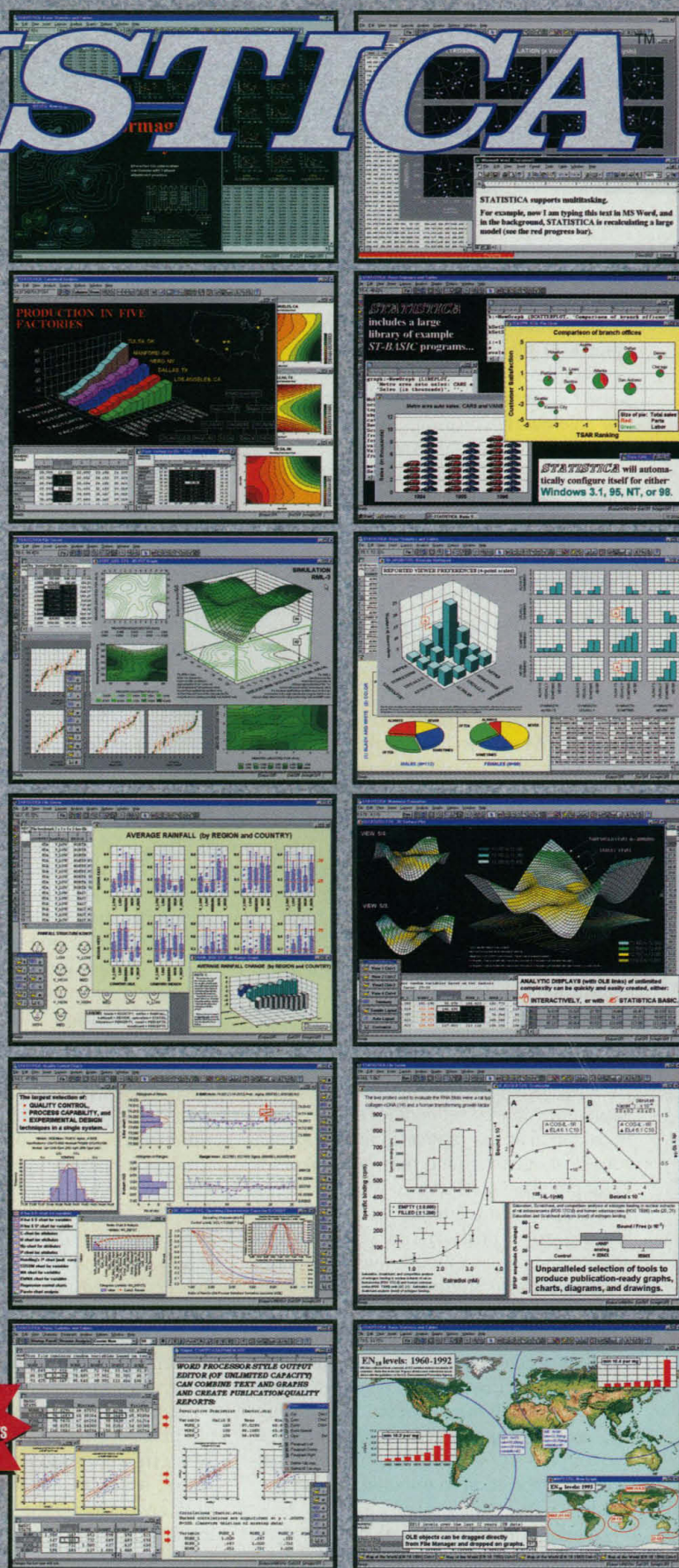
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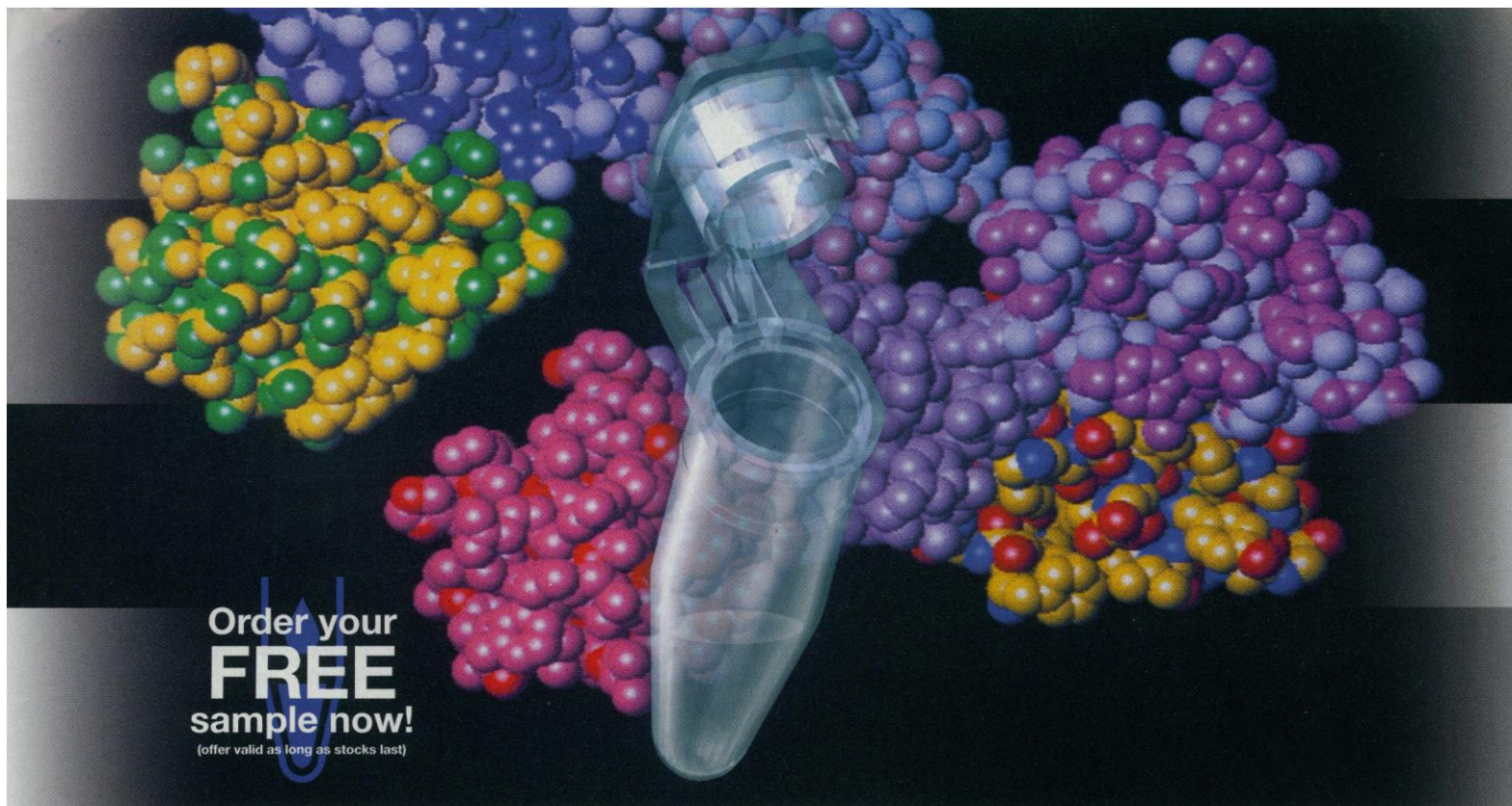
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Background picture: Insuline, computer generated molecular model

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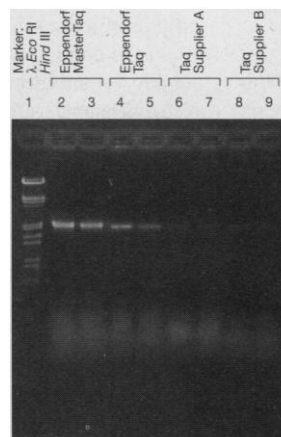


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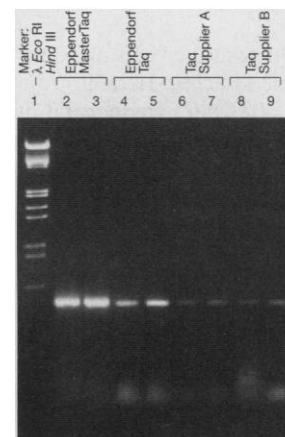
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● **Fig. 1: Amplification of a SSU rRNA gene from total genomic algae DNA**
PCR was performed from genomic algae using different Taq DNA Polymerases. Equal volumes of the PCR reactions were analyzed by gel electrophoresis.



● **Fig. 2: Amplification of a GAPDH specific DNA fragment from genomic blood DNA**
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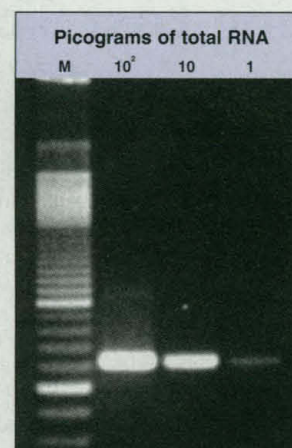
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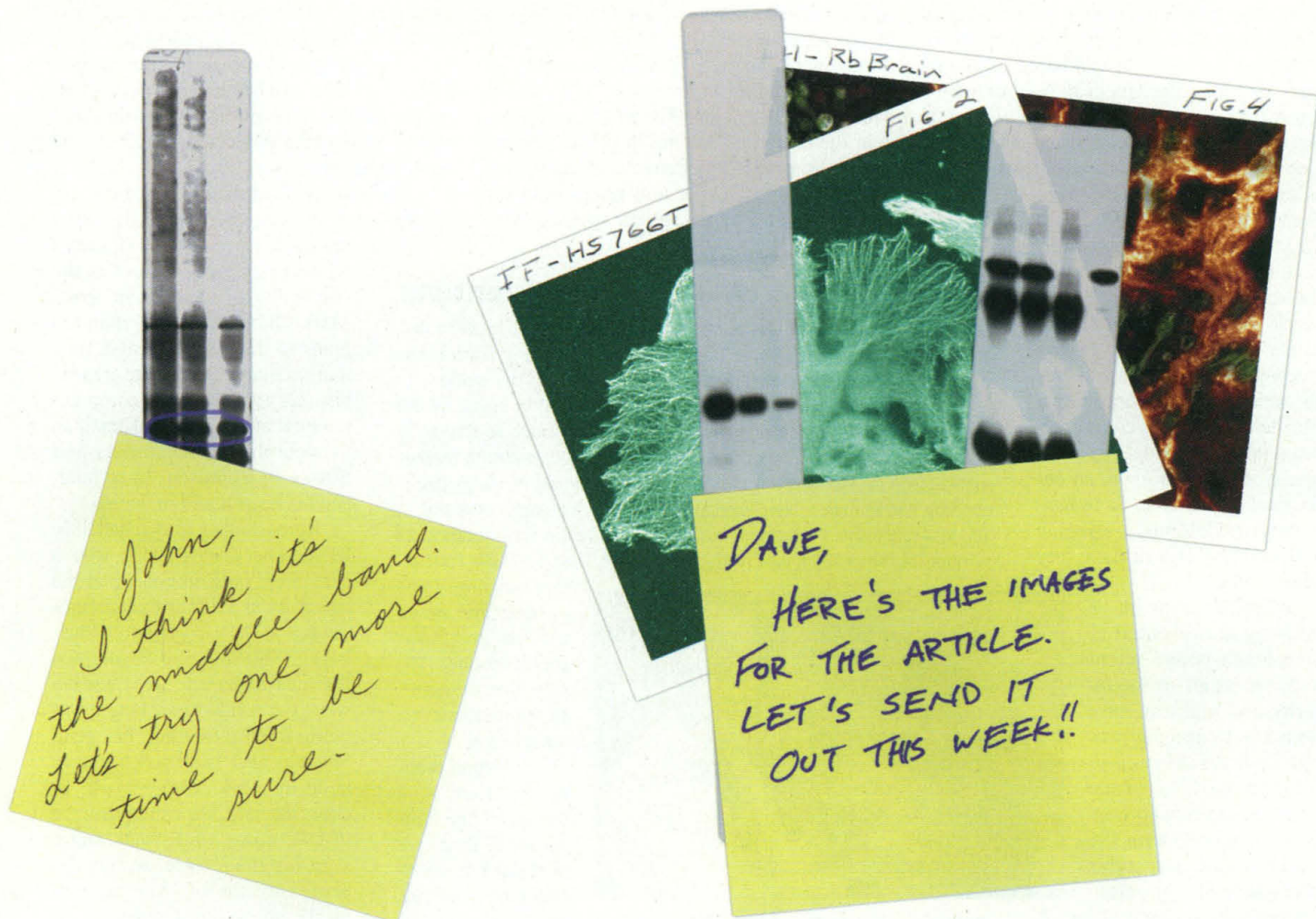
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IL-8			▲	Exclusive	▲
IL-8 US			▲		
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IL-17			▲		
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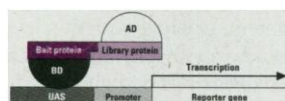
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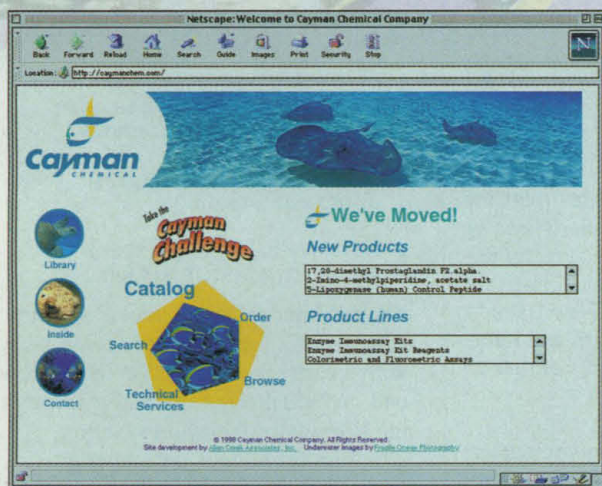
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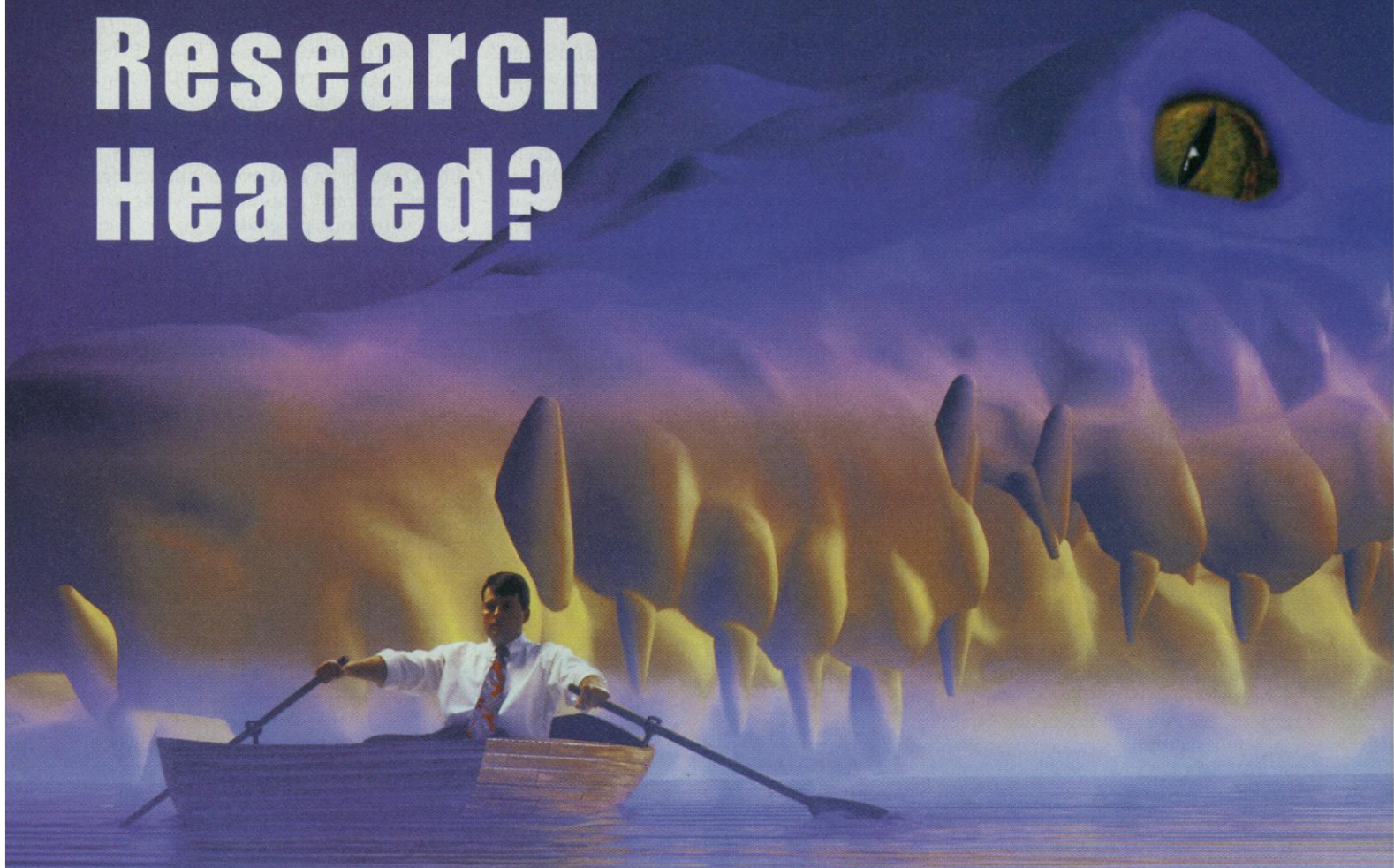
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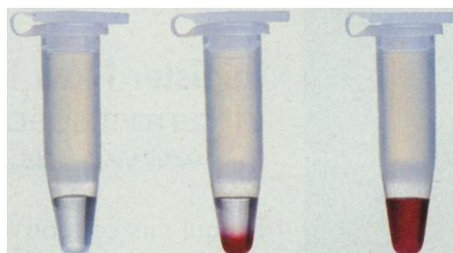
With REDTaq, post-PCR samples are dense enough to be loaded directly onto an agarose gel. The red dye serves as a tracking dye, migrating a little faster than bromophenol blue.

Greater Reaction-To-Reaction Consistency

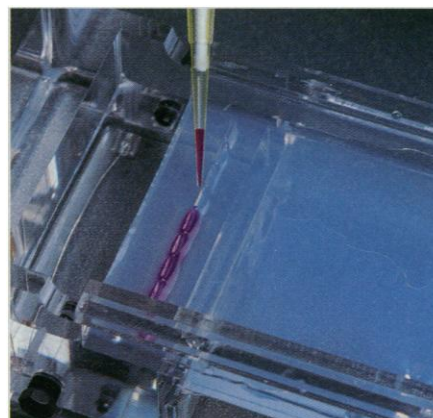
Because new REDTaq is formulated at one unit per μl , it's easier to pipette accurately. A uniform amount of enzyme added ensures consistency in the amount of end product.

[†] Patent pending.

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*It's easy to see when
REDTaq has been
added ... and when
it's been mixed.*



*Samples can be added
directly to an agarose
gel after PCR amplifi-
cation without the
addition of a loading
buffer or tracking dye.
The red dye migrates
at the same rate as a
125 bp fragment.*

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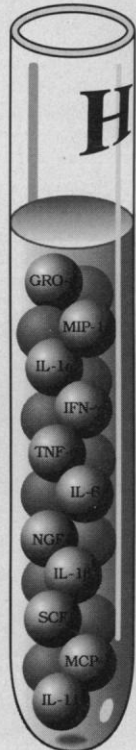
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Murine Reference Reagents Available: IFN-α; IFN-β; IFN-γ; GM-CSF; IL-3; IL-4; TNF-α.

To Obtain These Reagents, Contact:

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